Serial

ENET-232 Series and ENET-485 Series User Manual for Windows 2000/NT 4.0 and Linux *x*86/Solaris 2.*x*

NATIONAL INSTRUMENTS™

November 2001 Edition
Part Number 370323B-01

Worldwide Technical Support and Product Information

ni.com

National Instruments Corporate Headquarters

11500 North Mopac Expressway Austin, Texas 78759-3504 USA Tel: 512 683 0100

Worldwide Offices

Australia 03 9879 5166, Austria 0662 45 79 90 0, Belgium 02 757 00 20, Brazil 011 284 5011,
Canada (Calgary) 403 274 9391, Canada (Montreal) 514 288 5722, Canada (Ottawa) 613 233 5949,
Canada (Québec) 514 694 8521, Canada (Toronto) 905 785 0085, China (Shanghai) 021 6555 7838,
China (ShenZhen) 0755 3904939, Czech Republic 02 2423 5774, Denmark 45 76 26 00, Finland 09 725 725 11,
France 01 48 14 24 24, Germany 089 741 31 30, Greece 30 1 42 96 427, Hong Kong 2645 3186,
India 91805275406, Israel 03 6120092, Italy 02 413091, Japan 03 5472 2970, Korea 02 596 7456,
Malaysia 603 9596711, Mexico 001 800 010 0793, Netherlands 0348 433466, New Zealand 09 914 0488,
Norway 32 27 73 00, Poland 0 22 528 94 06, Portugal 351 1 726 9011, Russia 095 2387139,
Singapore 2265886, Slovenia 386 3 425 4200, South Africa 11 805 8197, Spain 91 640 0085,
Sweden 08 587 895 00, Switzerland 056 200 51 51, Taiwan 02 2528 7227, United Kingdom 01635 523545

For further support information, see the *Technical Support Resources* appendix. To comment on the documentation, send e-mail to techpubs@ni.com.

© 2000, 2001 National Instruments Corporation. All rights reserved.

Important Information

Warranty

The serial hardware is warranted against defects in materials and workmanship for a period of one year from the date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace equipment that proves to be defective during the warranty period. This warranty includes parts and labor.

The media on which you receive National Instruments software are warranted not to fail to execute programming instructions, due to defects in materials and workmanship, for a period of 90 days from date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace software media that do not execute programming instructions if National Instruments receives notice of such defects during the warranty period. National Instruments does not warrant that the operation of the software shall be uninterrupted or error free.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. National Instruments will pay the shipping costs of returning to the owner parts which are covered by warranty.

National Instruments believes that the information in this document is accurate. The document has been carefully reviewed for technical accuracy. In the event that technical or typographical errors exist, National Instruments reserves the right to make changes to subsequent editions of this document without prior notice to holders of this edition. The reader should consult National Instruments if errors are suspected. In no event shall National Instruments be liable for any damages arising out of or related to this document or the information contained in it.

EXCEPT AS SPECIFIED HEREIN, NATIONAL INSTRUMENTS MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AND SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S RIGHT TO RECOVER DAMAGES CAUSED BY FAULT OR NEGLIGENCE ON THE PART OF NATIONAL INSTRUMENTS SHALL BE LIMITED TO THE AMOUNT THERETOFORE PAID BY THE CUSTOMER. NATIONAL INSTRUMENTS WILL NOT BE LIABLE FOR DAMAGES RESULTING FROM LOSS OF DATA, PROFITS, USE OF PRODUCTS, OR INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY THEREOF. This limitation of the liability of National Instruments will apply regardless of the form of action, whether in contract or tort, including negligence. Any action against National Instruments must be brought within one year after the cause of action accrues. National Instruments shall not be liable for any delay in performance due to causes beyond its reasonable control. The warranty provided herein does not cover damages, defects, malfunctions, or service failures caused by owner's failure to follow the National Instruments installation, operation, or maintenance instructions; owner's modification of the product; owner's abuse, misuse, or negligent acts; and power failure or surges, fire, flood, accident, actions of third parties, or other events outside reasonable control.

Copyright

Under the copyright laws, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of National Instruments Corporation.

Trademarks

CVI™, LabVIEW™, Lookout™, Measurement Studio™, National Instruments™, NI™, NI-VISA™, and ni.com™ are trademarks of National Instruments Corporation.

Product and company names mentioned herein are trademarks or trade names of their respective companies.

Patents

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

U.S. Patent No(s).: 5,724,272; 5,710,727; 5,847,955; 5,640,572; 5,771,388; 5,627,988; 5,717,614

WARNING REGARDING USE OF NATIONAL INSTRUMENTS PRODUCTS

(1) NATIONAL INSTRUMENTS PRODUCTS ARE NOT DESIGNED WITH COMPONENTS AND TESTING FOR A LEVEL OF RELIABILITY SUITABLE FOR USE IN OR IN CONNECTION WITH SURGICAL IMPLANTS OR AS CRITICAL COMPONENTS IN ANY LIFE SUPPORT SYSTEMS WHOSE FAILURE TO PERFORM CAN REASONABLY BE EXPECTED TO CAUSE SIGNIFICANT INJURY TO A HUMAN.

(2) IN ANY APPLICATION, INCLUDING THE ABOVE, RELIABILITY OF OPERATION OF THE SOFTWARE PRODUCTS CAN BE IMPAIRED BY ADVERSE FACTORS, INCLUDING BUT NOT LIMITED TO FLUCTUATIONS IN ELECTRICAL POWER SUPPLY, COMPUTER HARDWARE MALFUNCTIONS, COMPUTER OPERATING SYSTEM SOFTWARE FITNESS, FITNESS OF COMPILERS AND DEVELOPMENT SOFTWARE USED TO DEVELOP AN APPLICATION, INSTALLATION ERRORS, SOFTWARE AND HARDWARE COMPATIBILITY PROBLEMS, MALFUNCTIONS OR FAILURES OF ELECTRONIC MONITORING OR CONTROL DEVICES, TRANSIENT FAILURES OF ELECTRONIC SYSTEMS (HARDWARE AND/OR SOFTWARE), UNANTICIPATED USES OR MISUSES, OR ERRORS ON THE PART OF THE USER OR APPLICATIONS DESIGNER (ADVERSE FACTORS SUCH AS THESE ARE HEREAFTER COLLECTIVELY TERMED "SYSTEM FAILURES"). ANY APPLICATION WHERE A SYSTEM FAILURE WOULD CREATE A RISK OF HARM TO PROPERTY OR PERSONS (INCLUDING THE RISK OF BODILY INJURY AND DEATH) SHOULD NOT BE RELIANT SOLELY UPON ONE FORM OF ELECTRONIC SYSTEM DUE TO THE RISK OF SYSTEM FAILURE. TO AVOID DAMAGE, INJURY, OR DEATH, THE USER OR APPLICATION DESIGNER MUST TAKE REASONABLY PRUDENT STEPS TO PROTECT AGAINST SYSTEM FAILURES, INCLUDING BUT NOT LIMITED TO BACK-UP OR SHUT DOWN MECHANISMS. BECAUSE EACH END-USER SYSTEM IS CUSTOMIZED AND DIFFERS FROM NATIONAL INSTRUMENTS' TESTING PLATFORMS AND BECAUSE A USER OR APPLICATION DESIGNER MAY USE NATIONAL INSTRUMENTS PRODUCTS IN COMBINATION WITH OTHER PRODUCTS IN A MANNER NOT EVALUATED OR CONTEMPLATED BY NATIONAL INSTRUMENTS, THE USER OR APPLICATION DESIGNER IS ULTIMATELY RESPONSIBLE FOR VERIFYING AND VALIDATING THE SUITABILITY OF NATIONAL INSTRUMENTS PRODUCTS WHENEVER NATIONAL INSTRUMENTS PRODUCTS ARE INCORPORATED IN A SYSTEM OR APPLICATION, INCLUDING, WITHOUT LIMITATION, THE APPROPRIATE DESIGN, PROCESS AND SAFETY LEVEL OF SUCH SYSTEM OR APPLICATION.

Compliance

FCC/Canada Radio Frequency Interference Compliance*

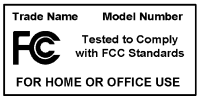
Determining FCC Class

The Federal Communications Commission (FCC) has rules to protect wireless communications from interference. The FCC places digital electronics into two classes. These classes are known as Class A (for use in industrial-commercial locations only) or Class B (for use in residential or commercial locations). Depending on where it is operated, this product could be subject to restrictions in the FCC rules. (In Canada, the Department of Communications (DOC), of Industry Canada, regulates wireless interference in much the same way.)

Digital electronics emit weak signals during normal operation that can affect radio, television, or other wireless products. By examining the product you purchased, you can determine the FCC Class and therefore which of the two FCC/DOC Warnings apply in the following sections. (Some products may not be labeled at all for FCC; if so, the reader should then assume these are Class A devices.)

FCC Class A products only display a simple warning statement of one paragraph in length regarding interference and undesired operation. Most of our products are FCC Class A. The FCC rules have restrictions regarding the locations where FCC Class A products can be operated.

FCC Class B products display either a FCC ID code, starting with the letters **EXN**, or the FCC Class B compliance mark that appears as shown here on the right.



Consult the FCC Web site at `http://www.fcc.gov` for more information.

FCC/DOC Warnings

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual and the CE Mark Declaration of Conformity**, may cause interference to radio and television reception. Classification requirements are the same for the Federal Communications Commission (FCC) and the Canadian Department of Communications (DOC).

Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the equipment under the FCC Rules.

Class A

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Department of Communications

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canadian Department of Communications

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Compliance to EU Directives

Readers in the European Union (EU) must refer to the Manufacturer's Declaration of Conformity (DoC) for information** pertaining to the CE Mark compliance scheme. The Manufacturer includes a DoC for most every hardware product except for those bought for OEMs, if also available from an original manufacturer that also markets in the EU, or where compliance is not required as for electrically benign apparatus or cables.

To obtain the DoC for this product, click **Declaration of Conformity** at `ni.com/hardref.nsf/`. This web site lists the DoCs by product family. Select the appropriate product family, followed by your product, and a link to the DoC appears in Adobe Acrobat format. Click the Acrobat icon to download or read the DoC.

* Certain exemptions may apply in the USA, see FCC Rules §15.103 **Exempted devices**, and §15.105(c). Also available in sections of CFR 47.

** The CE Mark Declaration of Conformity will contain important supplementary information and instructions for the user or installer.

Contents

About This Manual

Conventions xi
Related Documentation xii

Chapter 1
Introduction

How to Use This Manual 1-1
What You Need to Get Started 1-2
Optional Equipment 1-2
Serial Device Server Overview 1-3
Serial Port Overview 1-3
Feature Overview 1-3
LED Overview 1-4
Serial Server Software Overview 1-5
Windows 2000/NT 4.0 1-5
Linux *x*86/Solaris 2.*x* 1-6
Time-Saving Development Tools 1-6
Windows 2000/NT 4.0 1-6
Linux *x*86/Solaris 2.*x* 1-8

Chapter 2
Installation

Installing the Serial Server Software 2-1
Windows 2000/NT 4.0 2-1
Linux *x*86 2-1
Solaris 2.*x* 2-1
Installing the Serial Device Server 2-2
Step 1. Verify the Voltage Rating 2-2
Step 2. Record the Serial Number, Ethernet Address, and Default Hostname 2-2
Step 3. Connect the Cables 2-3
Step 4. Switch on Your Serial Device Server 2-4

Chapter 3
Ethernet Configuration

Entering Network Configuration Mode 3-1
Using NI Ethernet Device Configuration 3-2

Configuring the Network Settings 3-4
Static IP Parameters 3-6
Choosing a Static IP Address 3-6
For a Network Administered by a Network Administrator 3-6
For a Network without a Network Administrator 3-6
Verifying the Hostname 3-7

Chapter 4
Serial Port Configuration

Adding a New Serial Interface 4-1
Windows 2000/NT 4.0 4-1
Linux *x*86/Solaris 2.*x* 4-3
Viewing or Changing Communication Port Settings 4-3
Windows 2000/NT 4.0 4-3
COM Port Number 4-5
Transceiver Mode 4-5
Linux *x*86/Solaris 2.*x* 4-6

Chapter 5
Verify the Installation

Running Diagnostics 5-1
Windows 2000/NT 4.0 5-1
Linux *x*86/Solaris 2.*x* 5-2
Connecting Serial Devices 5-3

Chapter 6
Using Your Serial Device Server

General Programming Requirements 6-1
Windows 2000/NT 4.0 6-1
Linux *x*86/Solaris 2.*x* 6-1
Using DHCP 6-2
Using the CFG RESET Switch 6-3
Using the CFG RESET Switch during Operation 6-3
Using the CFG RESET Switch at Power-On 6-4
Updating the Firmware 6-5
Windows 2000/NT 4.0 6-6
Linux *x*86/Solaris 2.*x* 6-7
Configuring Transceiver Modes on the ENET-485 6-7
Four-Wire Mode 6-8
Two-Wire Mode: DTR with Echo 6-8
Two-Wire Mode: DTR Controlled 6-8

Two-Wire Mode: Auto Control....6-8
Setting the Transceiver Control Mode....6-9
Windows 2000/NT 4.0....6-9
Setting the Transceiver Mode with DeviceIoControl()....6-9
Linux *x*86/Solaris 2.*x*....6-10
Controlling the Transceiver Mode Programmatically....6-10
VI_ATTR_ASRL_WIRE_MODE....6-10
Changing the Bias Resistors on the ENET-485....6-11
Functionality of Bias Resistors....6-11
Changing Bias Resistors....6-12

Appendix A
Uninstalling the Software

Appendix B
PWR/RDY LED Signaling

Appendix C
Troubleshooting and Common Questions

Appendix D
Serial Port Information

Appendix E
Specifications

Appendix F
VISA and Serial APIs on UNIX

Appendix G
Technical Support Resources

Glossary

Index

About This Manual

This manual contains instructions to help you install and configure the National Instruments serial device server and the serial server software for Windows 2000/NT 4.0 (Service Pack 4 or higher) or Linux *x*86/Solaris 2.*x*. This manual includes information about the ENET-232 and ENET-485 serial device servers. It also assumes you are already familiar with your operating system.

Conventions

The following conventions appear in this manual:

»	The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
$\overline{\text{DTR}}$	Signal names with an overscore, such as $\overline{\text{DTR}}$, indicate that the signal is active low.
	This icon denotes a note, which alerts you to important information.
	This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.
bold	Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options. Bold text also denotes parameter names and LED names.
italic	Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.
`monospace bold`	Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are different from the other examples.

monospace italic	Italic text in this font denotes text that is a placeholder for a word or value that you must supply.
serial device server	*Serial device server* refers to all versions of the ENET-232 and ENET-485 hardware.
serial server software	S*erial server software* refers to the appropriate NI-Serial device server software for your operating system.

Related Documentation

The following documents contain information that you might find helpful as you read this manual:

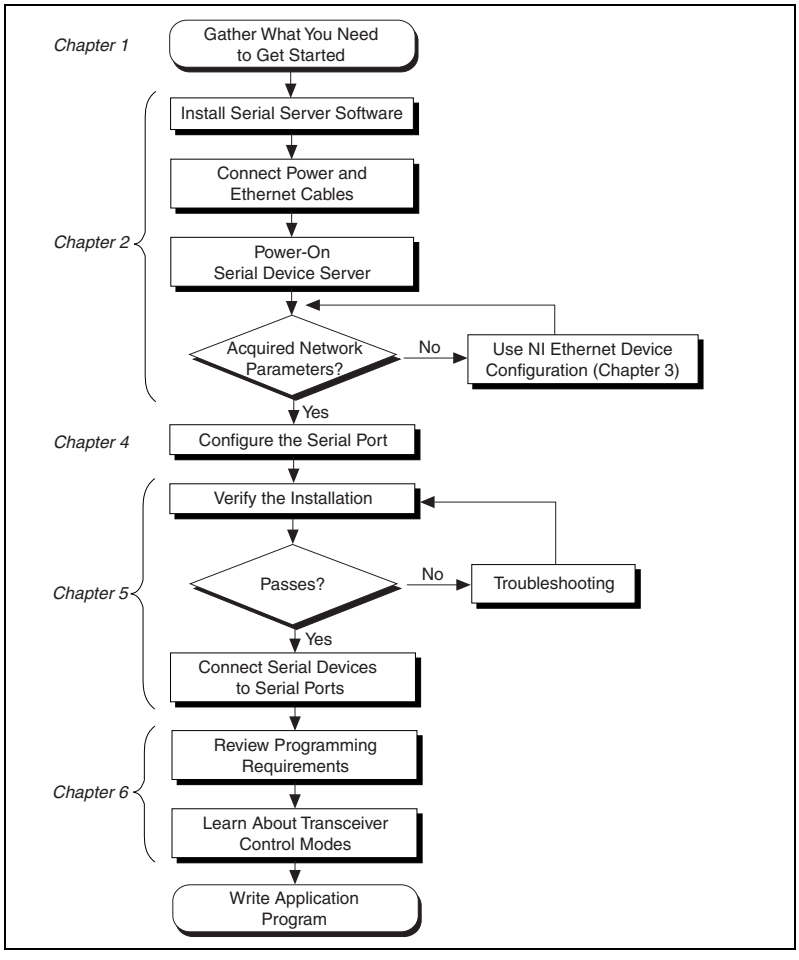
- ANSI/EIA-232-D Standard, *Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*
- ANSI/IEEE Standard 802.3-1988, *Information Processing Systems, Local Area Networks*, Part 3
- EIA/RS-422-A Standard, *Electrical Characteristics of Balanced Voltage Digital Interface Circuits*
- EIA-485 Standard, *Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*
- For Windows 2000/NT 4.0, *Microsoft Win32 Software Developer Kit*, *Online Documentation for Win32 Overviews*, *Win32 Reference*, *Microsoft Windows 2000 System Guide*, and *Microsoft Windows NT System Guide*, Microsoft Corporation
- For Linux *x*86/Solaris 2.*x*, VISA manuals in the `NIvisa` subdirectory of your installation

1

Introduction

This chapter lists what you need to get started and optional equipment you can order, and briefly describes the serial device server and the serial server software.

How to Use This Manual



What You Need to Get Started

Before you install your serial device server and the serial server software, make sure you have all the following items:

- ❑ One of the following operating systems installed on your computer:
  - Windows 2000
  - Windows NT 4.0 with Service Pack 4 or higher
  - Linux *x*86
  - Solaris 2.*x*
- ❑ TCP/IP protocol installed on your computer
- ❑ One of the following National Instruments (NI) serial device servers:
  - ENET-232 Series (two or four port)
  - ENET-485 Series (two or four port)
- ❑ Universal power supply and the appropriate cable for your area, supplied by NI
- ❑ One of the following Category 5 twisted-pair network cables:
  - Straight-through cable for connecting the serial device server to a network hub
  - Cross-over cable for connecting the serial device server directly to a computer's network interface card (NIC)
- ❑ NI-Serial device server software for your operating system, supplied by NI

Optional Equipment

For information about ordering the following optional equipment, contact National Instruments:

- DB-9 RS-485 termination connector (ENET-485 only)
- RS-232 9-pin to 9-pin straight-through cable
- RS-232 9-pin to 9-pin null modem cable
- RS-232 9-pin to 25-pin null modem cable

Serial Device Server Overview

Serial Port Overview

The ENET-232 and ENET-485 serial device servers give you a variety of solutions for serial communication. The serial device servers are available in a two-port version (ENET-232/2 and ENET-485/2) and a four-port version (ENET-232/4 and ENET-485/4). The ENET-232 works with the RS-232 protocols, and the ENET-485 works with the RS-422 and RS-485 protocols. You can use the ENET-232 for point-to-point serial communication up to distances of 15.6 m (50 ft.) per serial port. You can connect the ENET-485 for multidrop serial communications with up to 31 devices using serial cable lengths up to 1.2 km (4,000 ft.) per serial port.

The serial ports on the ENET-232 are DTE. In the RS-232 specification, DTE (Data Terminal Equipment) and DCE (Data Communications Equipment) refer to the types of equipment on either end of a serial connection. In general, DTE and DCE refer to computer equipment and modems, respectively. For more information about cabling the serial device server to other devices, refer to the *DTE vs. DCE* section in Appendix D, *Serial Port Information*.

The ENET-485 servers support four hardware transceiver control modes for reliable communication with two- and four-wire devices. For more information about transceiver control modes, refer to Chapter 6, *Using Your Serial Device Server*.

The serial device server contains FIFO (First-In-First-Out) buffers to reduce susceptibility to interrupt latency for faster transmission rates. Also, serial device servers contain additional onboard buffers to reduce susceptibility to Ethernet network traffic.

Feature Overview

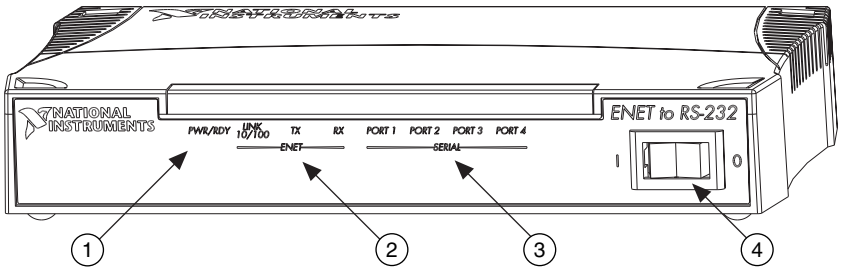
With the serial device server, you gain all the features inherent in a networked device: fewer cabling distance restrictions, device sharing, and communication with devices throughout the Internet. In a serial application, you usually are restricted to the distance limitations of the RS-232, RS-422, or RS-485 specifications. Because the serial device server uses Ethernet, you can add an unlimited distance to your application by exploiting the distances available using a networked device. Device sharing with a serial device server happens on a per-port basis. That is, although the serial device server supports network connections from multiple hosts, each serial port is associated with only one host at a time.

Dynamic Host Configuration Protocol (DHCP) is available on many networks to configure network parameters automatically. DHCP simplifies the installation and configuration process for the serial device server. For more information about DHCP, refer to the section, *Using DHCP*, in Chapter 6, *Using Your Serial Device Server*.

If your network does not support DHCP, use NI Ethernet device configuration as described in Chapter 3, *Ethernet Configuration*, to configure network parameters for the serial device server.

LED Overview

Figure 1-1 shows the light-emitting diodes (LEDs) on the ENET-232/4 serial device server. The LEDs are visible from the top and front of the unit.



1	Power/Ready LED	3	Serial Port LEDs
2	Ethernet LEDs	4	Power Switch

Figure 1-1. Front Panel of a Four-Port Serial Device Server

The LEDs show the current status of the serial device server. Table 1-1 describes each LED.

Table 1-1. LED Descriptions

LED	Description
PWR/RDY	Flashes rapidly at start-up while performing self tests and when acquiring network parameters. A steady yellow state indicates the box is ready for operation. Slow flashing pattern indicates an error occurred.
LINK 10/100	Indicates the serial device server detected a twisted pair (10Base-T or 100Base-TX) link. The color indicates the connection speed. If yellow, the speed is 10 Mbits/s. If green, the speed is 100 Mbits/s.
TX	Indicates the serial device server is transmitting to the Ethernet network.
RX	Indicates the serial device server is receiving Ethernet network traffic.
PORT *x*	Indicates which serial ports are open.

Serial Server Software Overview

Windows 2000/NT 4.0

The serial server software for Windows 2000/NT includes a native Windows 2000/NT kernel driver that provides full interrupt-driven, buffered I/O for multiple COM ports. Using this driver, you can obtain a maximum baud rate of 460.8 kbits/s for the ENET-485 and 230.4 kbits/s for the ENET-232.

The serial server software includes the following components:

- Device driver
- Serial Configuration utility (NI Ports)
- NI Ethernet Device Configuration utility
- Serial Device Server Diagnostics utility
- NI Ethernet Device Firmware Update utility

You can use the serial server software to add COM ports to your computer. The software makes the serial ports on the serial device server appear as standard COM ports under Windows 2000/NT. After installing the software, using the serial ports is similar to using standard Win32 COM ports. Furthermore, any program using the communication interface can use the serial device server as if it were a local COM port.

Linux *x*86/Solaris 2.*x*

On Linux *x*86/Solaris 2.*x*, you can use the NI-VISA Application Programming Interface (API) to control the serial ports on the serial device server. NI-VISA is the National Instruments implementation of the industry-standard Virtual Instrument System Architecture (VISA) specification. Appendix F, *VISA and Serial APIs on UNIX*, compares NI-VISA to the UNIX serial API and explains why the NI-VISA API was chosen. (The `NIvisa` subdirectory of your installation also contains more information about NI-VISA.) Using NI-VISA, you can obtain a maximum baud rate of 460.8 kbits/s for the ENET-485 and 230.4 kbits/s for the ENET-232.

The software includes the following components:

- NI-VISA run-time engine
- NI-VISA ANSI C development header files
- NI-VISA configuration utility (`visaconf`) for configuring NI Ethernet devices and serial ports
- NI-VISA Interactive Controller (`NIvisaic`) for interactive API control
- NI Ethernet Device Firmware Update utility (`FirmwareUpdate`)

Time-Saving Development Tools

Windows 2000/NT 4.0

Your kit includes the serial server software for Windows 2000/NT. After you install your serial device server and the serial server software, you can use any applications that make standard Windows serial-I/O function calls. Development environments such as Visual Basic, Visual C++, and Excel, as well as the following National Instruments applications software products, can access the add-in serial ports using standard serial I/O functions.

LabVIEW is a graphical programming environment you can use to acquire data from thousands of different instruments, including IEEE 488.2 devices, VXI devices, serial devices, PLCs, and plug-in data acquisition boards. After you acquire raw data, you can convert it into meaningful results using the data analysis routines in LabVIEW. The LabVIEW instrument drivers reduce software development time because you do not need to program the low-level control of each instrument.

Lookout is an object-oriented automation software system that uses drag-and-drop to build applications with clients and servers. Lookout uses TCP/IP networking and the Internet to implement systems on corporate and factory Ethernet networks. Serial driver objects that do not use external port handlers can use the same COM port.

Measurement Studio bundles LabWindows/CVI for C, and measurement tools for Microsoft Visual C++ and Microsoft Visual Basic. Measurement Studio is designed for building measurement and automation applications with the programming environment of your choice:

- LabWindows/CVI is an interactive ANSI C programming environment designed for building virtual instrument applications. LabWindows/CVI delivers a drag-and-drop editor for building user interfaces, a complete ANSI C environment for building your test program logic, and a collection of automated code generation tools, as well as utilities for building automated test systems, monitoring applications, or laboratory experiments.
- Measurement Studio Tools for Visual C++ takes advantage of COM and ActiveX technologies to help you build measurement and automation applications. With the Visual C++ application wizard and instrument classes, you can use the IEEE 488.2 library to send and receive commands to and from instruments, and you can use VISA, an industry-standard I/O library, to communicate with GPIB, VXI, or serial devices using the same set of components.
- For Visual Basic programmers, Measurement Studio includes a collection of ActiveX controls designed for building virtual instrumentation systems. You can use the GPIB, serial, and VISA I/O controls and property pages to configure communication with your instruments.

If you already have one or more of these applications and want to use them with your serial device server, refer to your product documentation for information about serial I/O functions. For ordering information, contact National Instruments.

Linux *x*86/Solaris 2.*x*

You can develop NI-VISA applications using any ANSI C compiler. For Solaris, National Instruments offers LabWindows/CVI, which is an interactive ANSI C programming environment for building virtual instrument applications. LabWindows/CVI includes a drag-and-drop editor for building user interfaces, a complete ANSI C environment for building test program logic, a collection of automated code generation tools, and utilities for building automated test systems, monitoring applications, or conducting laboratory experiments.

NI-VISA also has a graphical API as part of LabVIEW, a National Instruments graphical programming environment. With LabVIEW, you control your system and present your results through interactive graphical front panels. You can acquire data from thousands of devices, including GPIB, VXI , PXI, serial devices, PLCs, and plug-in data acquisition (DAQ) boards. You can also connect to other data sources via the Internet, interapplication communication such as ActiveX, Dynamic Data Exchange (DDE), and Structured Query Language (SQL) database links. For complete flexibility in the LabVIEW open development environment, you can call any external or existing code in the form of a Dynamic Linked Library (DLL) under Windows or a shared library on any other platform. After you acquire the data, you can convert your raw measurements into polished results using the powerful LabVIEW data analysis and visualization capabilities. LabVIEW simplifies and reduces the development time of a complete system.

To order LabVIEW or LabWindows/CVI, contact National Instruments.

2

Installation

This chapter describes how to install the serial server software and the serial device server.

Installing the Serial Server Software

Windows 2000/NT 4.0

Complete the following steps to install the serial server software for Windows 2000/NT:

1. Log in as `Administrator` or as a user who has administrator privileges.
2. Insert the *NI-Serial Device Server Software for Windows 2000/NT* CD (or disk 1 of the floppy disk set) and run the setup program, `setup.exe`.
3. The setup wizard guides you through the necessary steps to install the serial server software. To exit the setup wizard at any time, click the **Cancel** button.

Linux *x*86

Complete the following steps to install the serial server software on Linux *x*86:

1. Log in as `root` (superuser with administrative privileges).
2. Insert the *NI-Serial Device Server Software for Linux x86/Solaris 2.x* CD. Run the installation script `INSTALL` from the `VISA` subdirectory of the appropriate directory. The default installation path is `/usr/local/vxipnp/`.
3. Follow any onscreen prompts.

Solaris 2.*x*

Complete the following steps to install the serial server software on Solaris 2.*x*:

1. Log in as `root` (superuser with administrative privileges).

2. Insert the *NI-Serial Device Server Software for Linux x86/Solaris 2.x* CD. Run the installation script `INSTALL` from the `VISA` subdirectory of the appropriate directory. The default installation path is `/opt/vxipnp/`.
3. Follow any onscreen prompts.

Installing the Serial Device Server

Complete the following steps to install your serial device server.

Step 1. Verify the Voltage Rating

The serial device server uses a universal power supply. Before you use your serial device server, verify that the voltage rating listed on the external power supply matches the voltage supplied in your area.

Caution If you do not use the power supply included in your kit, ensure that you do not operate your serial device server at any voltage other than the one specified on the rear panel. Doing so could damage the unit.

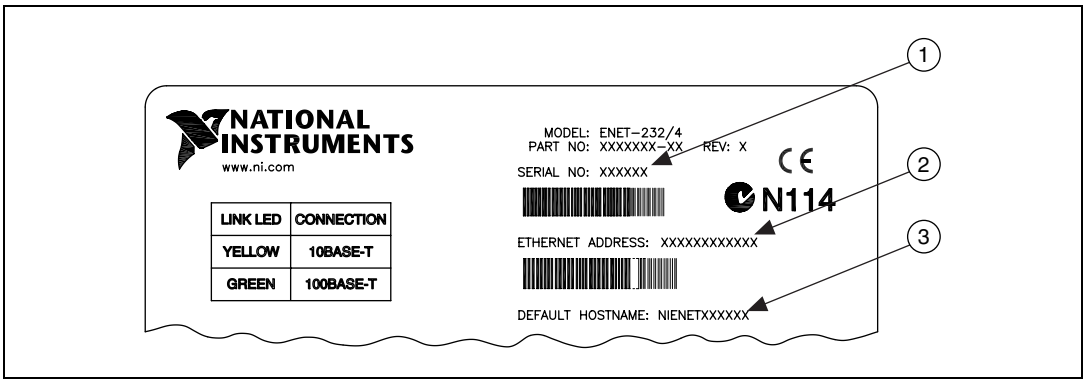
Step 2. Record the Serial Number, Ethernet Address, and Default Hostname

When you configure the serial device server for use on your network, you will need to differentiate it from other network devices. Every product has a unique serial number, Ethernet address, and default hostname.

1. Locate the serial number, Ethernet address, and default hostname on the baseplate label of the serial device server, as indicated in Figure 2-1.
2. Record this information on the front page of the *Getting Started* card that came with your kit.

   Recording this information is not necessary for proper installation. However, you will find it convenient when you configure the serial device server.

Note The Ethernet address is not the IP address. All devices on an Ethernet network are assigned a unique physical address—the Ethernet address—so they can communicate with each other.



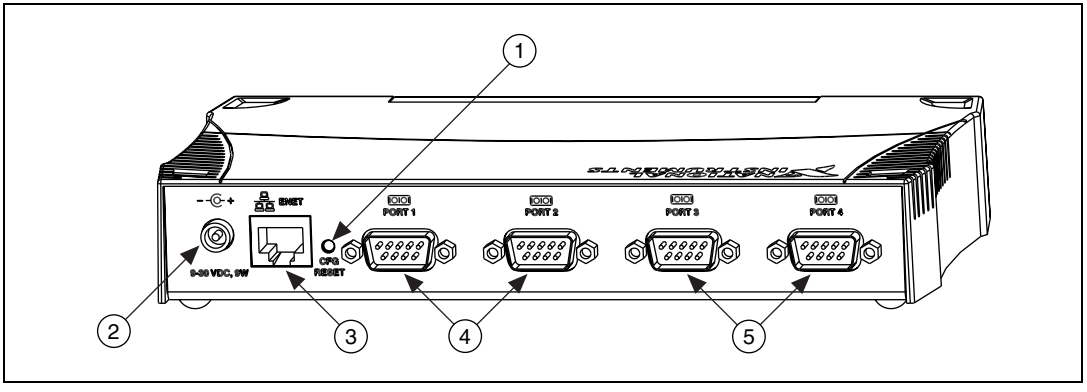
1	Serial Number	2	Ethernet Address	3	Default Hostname

Figure 2-1. Serial Device Server Baseplate Identification Label

You can change the hostname after you finish the installation and configuration steps in this chapter. Refer to the *Configuring the Network Settings* section in Chapter 3, *Ethernet Configuration*, for more information.

Step 3. Connect the Cables

Figure 2-2 shows the power, Ethernet, and serial port connection locations on the serial device server rear panel.



1	Configuration Reset Switch	4	Serial Ports 1 and 2
2	Power Connection	5	Serial Ports 3 and 4 (on 4-Port Models Only)
3	Ethernet Connection		

Figure 2-2. Rear Panel of a Four-Port Serial Device Server

To connect your cables, complete the following steps:

1. Connect one end of your Ethernet cable to your serial device server. Connect the other end of the Ethernet cable to your Ethernet network. Make sure you comply with all IEEE 802.3 cabling restrictions.
2. Secure the power connection by screwing the power connector onto the power jack of the serial device server. Plug the wall-mount power supply into an AC outlet of the correct voltage.

Note National Instruments does not recommend connecting serial devices to your serial ports until you configure the serial server software as described in Chapter 4, *Serial Port Configuration*, and verify the installation as described in Chapter 5, *Verify the Installation*. If you do not intend to verify the installation, you can connect your serial devices at this time.

For more information about the serial cable connections, see Appendix D, *Serial Port Information*.

Step 4. Switch on Your Serial Device Server

Before you power-on your serial device server, contact your network administrator to determine whether you need to configure your network settings manually using NI Ethernet device configuration or use the Dynamic Host Configuration Protocol (DHCP) to perform the configuration automatically.

When you turn on the front-panel power switch, the **PWR/RDY** LED alternates rapidly between red and yellow while the unit completes its power-on self-tests and attempts to acquire its network parameters. By default, the serial device server attempts its network configuration through DHCP.

The time required for assigning the IP address depends on your network and the configuration of your serial device server. Allow up to 90 seconds and observe the state of the **PWR/RDY** LED to determine the outcome of the self tests. One of the following should occur:

- A steady yellow **PWR/RDY** LED indicates the serial device server passed its self tests and acquired its IP address. The unit is now ready to operate. When using DHCP, the serial device server typically is ready to operate about 15 seconds after you power it on. Follow the instructions in Chapter 4, *Serial Port Configuration*, to add the serial ports to your computer.

- If the **PWR/RDY** LED continues to alternate rapidly between red and yellow, the unit was unable to use DHCP to configure its network parameters. If your network does not have DHCP, follow the instructions in Chapter 3, *Ethernet Configuration*, to give your unit its network configuration. If this is successful, the **PWR/RDY** LED should become steady yellow. Then you can follow the instructions in Chapter 4, *Serial Port Configuration*, to add the serial ports to your computer. Refer to Appendix C, *Troubleshooting and Common Questions*, if the LED does not change to steady yellow.
- If the **PWR/RDY** LED is steady red, the serial device server has an unrecoverable error. Contact National Instruments Technical Support.
- If the **PWR/RDY** LED blinks a slow red/yellow pattern, the serial device server did not pass its self tests. Refer to Appendix B, *PWR/RDY LED Signaling*, to interpret the flash pattern before calling National Instruments Technical Support.

You can skip Chapter 3, *Ethernet Configuration*, if your serial device server can use DHCP. However, you must use NI Ethernet device configuration to change the hostname from the default hostname listed on the baseplate label.

Note If at any time you want to return the serial device server to its default configuration state as given on the baseplate identification label, press and hold the CFG RESET switch for three seconds at power-on. This switch is on the rear panel, as shown in Figure 2-2. Refer to the *Using the CFG RESET Switch* section in Chapter 6, *Using Your Serial Device Server*, for more information.

3

Ethernet Configuration

This chapter describes how to use NI Ethernet device configuration to configure the network parameters of a serial device server on your subnet. With it, you can do the following:

- Manually configure the network parameters or enable DHCP
- Verify or change the device hostname
- Add or change a comment to help identify the device

The serial device server must be in network configuration mode before you can make changes to the network parameters.

Entering Network Configuration Mode

If DHCP is available on your network, it configures the network parameters for your serial device server at startup. In this case, using NI Ethernet device configuration is not necessary.

If the serial device server is configured to use DHCP, and DHCP is unavailable, the unit automatically enters network configuration mode after a 60 second timeout. The unit must be in this mode before you can make changes to the network parameters.

You also can enter this mode during normal operation by pressing and holding the CFG RESET switch for three seconds. Refer to the section *Using the CFG RESET Switch*, in Chapter 6, *Using Your Serial Device Server*, for more information on using this switch.

While in network configuration mode, the **PWR/RDY** LED alternates rapidly between red and yellow, and normal operation is halted.

Note If you only want to view the network configuration settings without making changes, you do not need to place the unit into network configuration mode. While in normal operation, you can follow the instructions in the following section, *Using NI Ethernet Device Configuration*, and examine the properties for any National Instruments Ethernet device on your subnet. However, any changes you attempt to make to the network parameters while in normal operating mode will not take effect.

Using NI Ethernet Device Configuration

If your network administrator tells you to assign the IP address manually, complete the following steps to configure the IP address settings.

1. **(Windows 2000/NT 4.0 only)** Select **Start»Programs»National Instruments Serial Server»Ethernet Device Configuration**.

   (Linux *x*86/Solaris 2.*x* only) Run `visaconf`, which is in the `NIvisa` subdirectory of your installation. Click on **Add Static**, which brings up the **Add New Static Resource** window. From the **Select the interface** listbox, select **NI ENET Serial Box**. In the right pane, click **Browse…** to bring up the **NI Ethernet Device Configuration** window.

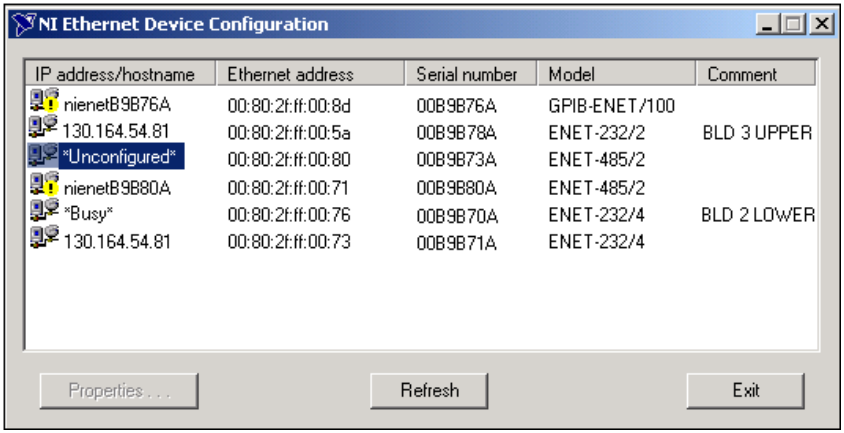


Figure 3-1. NI Ethernet Device Configuration Window

2. The **NI Ethernet Device Configuration** window displays a list of devices found on your subnet, sorted by model. You can identify your device by the Ethernet address or the serial number found on the baseplate label. The listed devices can be in one of four possible states, as indicated in the **IP address/hostname** column:
   - A hostname indicates DHCP has successfully configured the device.
   - A numerical IP address indicates the device has successfully been configured with a static IP address.
   - **`*Unconfigured*`** indicates the device is configured to use DHCP, but DHCP failed to attain network parameters.
   - **`*Busy*`** indicates the device is configured to use DHCP and currently is attempting to acquire network parameters.

Select your serial device server and click **Properties...** for any of the following reasons:

- You need to configure an unconfigured IP address.
- You need to change the current network parameters.
- You previously used DHCP, but it is no longer available.
- You are using DHCP and need to change the serial device server hostname.
- The **IP address/hostname** column displays an exclamation point (**!**) next to your serial device server, indicating a configuration problem. Refer to the *Verifying the Hostname* section for help resolving this problem.
- You want to add or change a comment to help identify the device.

Click **Refresh** if you do not see your serial device server in the list of Ethernet devices, or to discover a device that you recently added to the network.

Click **Exit** (or **Cancel**) if you are using DHCP and you do not need to change the hostname of the serial device server, or if you are finished using NI Ethernet device configuration.

Configuring the Network Settings

Your serial device server must be in network configuration mode if you want to change its network settings. Any changes you make while in normal operating mode will not take effect.

1. When you select **Properties...** from the **NI Ethernet Device Configuration** window, the utility displays the properties for your serial device server, similar to the following example.

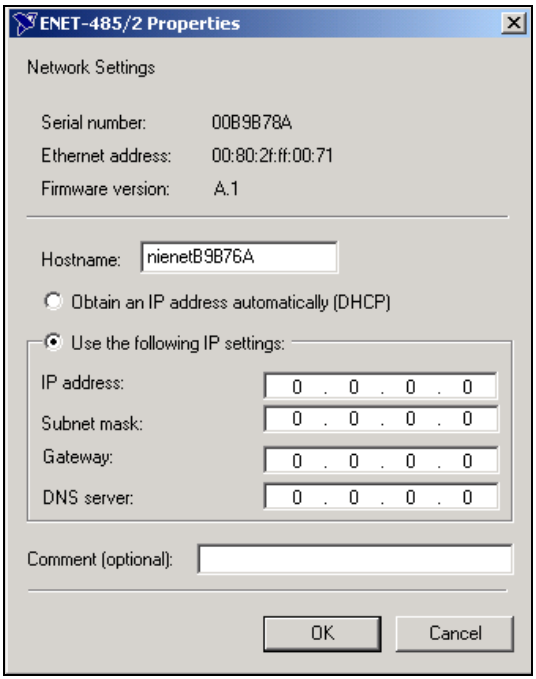


Figure 3-2. Properties Window for an Unconfigured Serial Device Server

The current hostname is displayed. The hostname associates a name with a numerical IP address. **Hostname** is a required field.

The serial device server attempts to use the hostname when registering with DHCP. Many DHCP servers can register the hostname and assigned IP address. You then can reliably use the hostname to communicate with your serial device server even if the numerical IP address changes.

However, some DHCP servers do not implement hostname registration. The serial device server requires domain name server (DNS) registration when using DHCP. If your DHCP server does not support DNS registration, you must use static network parameters.

Consult your network administrator for more details. For more information about DHCP, refer to the *Using DHCP* section in Chapter 6, *Using Your Serial Device Server*.

2. In the **Properties** window, select either **Obtain an IP address automatically (DHCP)** or **Use the following IP settings**.
3. If you select **Obtain an IP address automatically (DHCP)**, you do not need to enter any network parameters unless you want to change the hostname of the Ethernet device. If you select **Use the following IP settings**, enter the network parameters you have chosen for the host IP address, subnet mask, gateway IP, and DNS server IP, as in the example shown in Figure 3-3. Refer to the *Static IP Parameters* section for more information.

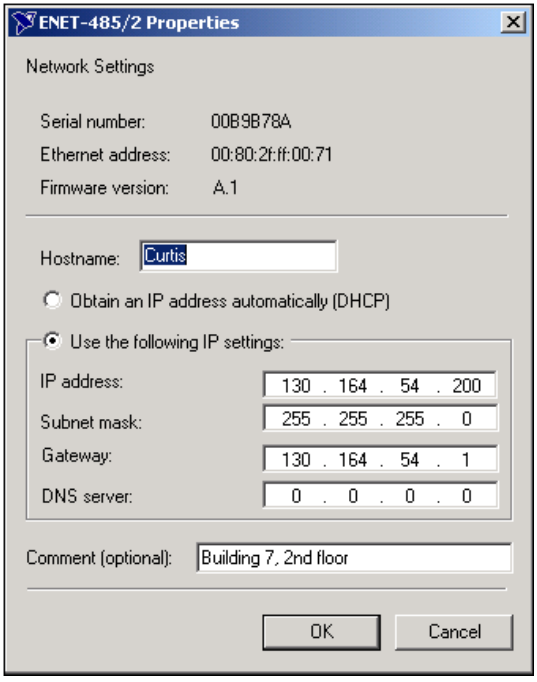

ENET-485/2 Properties
Network Settings
Serial number: 00B9B78A
Ethernet address: 00:80:2f:ff:00:71
Firmware version: A.1
Hostname: Curtis
Obtain an IP address automatically (DHCP)
Use the following IP settings:
IP address: 130 . 164 . 54 . 200
Subnet mask: 255 . 255 . 255 . 0
Gateway: 130 . 164 . 54 . 1
DNS server: 0 . 0 . 0 . 0
Comment (optional): Building 7, 2nd floor
OK
Cancel

Figure 3-3. Specifying IP Settings

Note The IP settings in Figure 3-3 are shown only as a format example.

4. You can enter an optional comment to help you identify the device.

5. Click **OK** to configure the device, or **Cancel** to exit without saving the configuration changes.
6. Click **Exit** (or **Cancel**) to close the NI Ethernet Device Configuration window.

The device automatically reboots with the new configuration in effect.

Static IP Parameters

If DHCP is not available, you must provide the serial device server with several important network parameters. These parameters are listed below.

- **IP address**—The unique, computer-readable address of a device on your network. An IP address typically is represented as four decimal numbers separated by periods (for example, `130.164.54.200`). Refer to the next section, *Choosing a Static IP Address*.
- **Subnet mask**—A code that helps the network device determine whether another device is on the same network or a different network.
- **Gateway IP**—The IP address of a device that acts as a gateway, which is a connection between two networks. If your network does not have a gateway, set this parameter to `0.0.0.0`.
- **DNS Server**—The IP address of a network device that stores hostnames and translates them into IP addresses. If your network does not have a DNS server, set this parameter to `0.0.0.0`.

Choosing a Static IP Address

For a Network Administered by a Network Administrator

If you are adding the serial device server to an existing Ethernet network, you must choose IP addresses carefully. Contact your network administrator to obtain an appropriate static IP address for your serial device server. Also, have the network administrator assign the proper subnet mask, gateway, and DNS server addresses.

For a Network without a Network Administrator

If you are assembling your own small Ethernet network, you can choose your own IP addresses. The subnet mask determines the IP address format. You should use the same subnet mask as the computer you are using to configure your serial device server. If your subnet mask is `255.255.255.0`, the first three numbers in every IP address on the

network must be the same. If your subnet mask is `255.255.0.0`, only the first two numbers in the IP addresses on the network must match.

For either subnet mask, numbers between 1 and 254 are valid choices for the last number of the IP address. Numbers between 0 and 255 are valid for the third number of the IP address, but this number must be the same as other devices on your network if your subnet mask is `255.255.255.0`.

If you are setting up your own network, you probably do not have a gateway or DNS server, so you should set these values to `0.0.0.0`.

Verifying the Hostname

NI Ethernet device configuration automatically verifies that the hostname for each DHCP-enabled device matches the DNS entry for the assigned IP address. This verification process automatically occurs when you either run the utility or click **Refresh**. The utility alerts you as shown below if it detects a problem with the network settings.

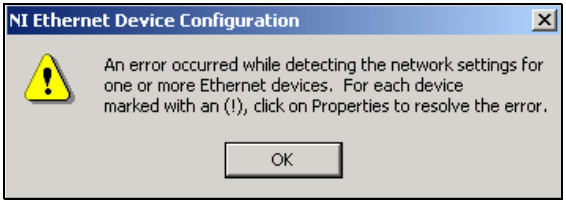

NI Ethernet Device Configuration
An error occurred while detecting the network settings for one or more Ethernet devices. For each device marked with an (!), click on Properties to resolve the error.
OK

Figure 3-4. Hostname Verification Error Detected

To correct the problem with the hostname, complete the following steps:

1. Locate the device that has a problem. This is indicated by an (**!**) on the device icon, as shown previously in Figure 3-1.
2. Select **Properties...**. A dialog box similar to the following appears.

NI Ethernet Device Configuration
This device uses DHCP and is configured to use hostname "nienet123456." However, the DHCP server assigned it the hostname "pcp003879pcs." Your device must be configured with a valid hostname to function properly.
Select one of the following options to correct the error:
Change the device's hostname to match the DNS entry.
Use static network parameters instead of DHCP. Contact your network administrator to obtain a valid IP address, subnet and gateway.
Edit the current hostname. Contact your network administrator for a valid name.
Keep the existing hostname. Contact your network administrator to update the DNS table.
OK

Figure 3-5. Resolving a Hostname Verification Error

3. The utility gives you four options for resolving the verification error. Select the one that best fits your situation and click **OK**.
   - **Change the device's hostname to match the DNS entry.** Use this option if you want to accept the hostname the DHCP server assigns, or if you cannot contact the network administrator to change the DNS entry.
   - **Use static network parameters instead of DHCP.** Use this option if you cannot use the hostname the DHCP server assigns. Contact your network administrator to obtain a valid IP address, subnet, and gateway. This option disables DHCP on the device.
   - **Edit the current hostname.** Use this option to change the hostname to a name other than either the configured hostname or the name the DHCP server assigns. Contact your network administrator to obtain a valid name.
   - **Keep the existing hostname**. Use this option to keep the previously assigned hostname. If you select this option, contact your network administrator to change the DNS entry.

4. Review the network parameter settings in the **Properties** window.
5. Confirm that the device is in network configuration mode and click **OK**. The device reboots with the new settings in effect.
6. After the device reboots, click **Refresh** to verify that the hostname is now valid.

4

Serial Port Configuration

This chapter describes how to configure your computer to use the serial device server.

Adding a New Serial Interface

Windows 2000/NT 4.0

The Serial Configuration utility is fully integrated into the Windows 2000/NT Control Panel. Use this utility to add a new serial interface.

1. Select **Start»Settings»Control Panel»NI Ports** to launch the Serial Configuration utility.
2. Select a new interface from the **Add a New Serial Interface** pull-down listbox and click **Add**.

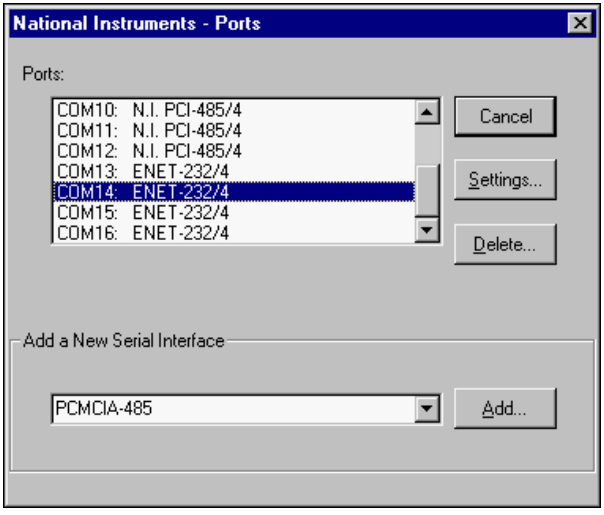


Figure 4-1. Adding a New Serial Interface

3. When the NI-Serial Device Server window appears, enter either an IP address or a hostname to identify the serial device server. Click **OK**.

   If DHCP configured the network parameters, enter the hostname the serial device server is using. Use the default hostname listed on the baseplate label unless you changed the hostname using the NI Ethernet Device Configuration utility.

   If DHCP did not configure the network parameters, enter the static IP address you configured for your serial device server using the NI Ethernet Device Configuration utility.

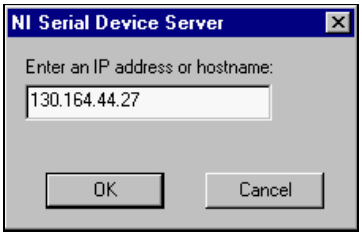


Figure 4-2. Specifying a Serial Device Server

4. Review the information on the Serial Device Confirmation window that appears.

Figure 4-3. Serial Device Server Confirmation

5. Click **Yes** to add the device or **No** to cancel the operation.
6. You must reboot your system at this time for your serial server software configuration to take effect. Select **Start»Shut Down» Restart**.

National Instruments recommends you verify the installation as described in Chapter 5, *Verify the Installation*. You then can connect serial devices to the serial ports on the serial device server.

Linux *x*86/Solaris 2.*x*

Use VISA Configuration to add a new serial interface.

1. Run `visaconf`, which is in the `NIvisa` subdirectory of your installation. Click **Add Static,** which brings up the **Add New Static Resource** window. From the **Select the interface** listbox, select **NI ENET Serial Box**.
2. Fill in the **Hostname or IP address** box in one of the following ways:
   - If the serial device server is on the same subnet, click **Browse…**. This brings up the NI Ethernet Device Configuration window, from which you can highlight the appropriate device. Click **Select**. The **Hostname or IP address** box is filled automatically.
   - If DHCP configured the network parameters, type in the serial device server hostname. (Use the default hostname listed on the baseplate label unless you changed the hostname using NI Ethernet device configuration.) If DHCP did not configure the network parameters, type in the serial device server static IP address you configured using NI Ethernet device configuration.
3. Click **OK** to finish. The **VISA Configuration** window should now show the new static addition(s) under the **Ethernet Serial** node.
4. Exit **VISA Configuration**. If you see the question **`Do you wish to commit all your changes to VISA?`**, answer **Yes**.

National Instruments recommends you verify the installation as described in Chapter 5, *Verify the Installation*.

Viewing or Changing Communication Port Settings

Windows 2000/NT 4.0

This section describes how to use the Serial Configuration utility to view or change the configuration of your serial ports.

1. Log in as `Administrator` or as a user who has administrator privileges.
2. Select **Start»Settings»Control Panel»NI Ports**. A list of installed National Instruments ports appears, as shown in Figure 4-4.

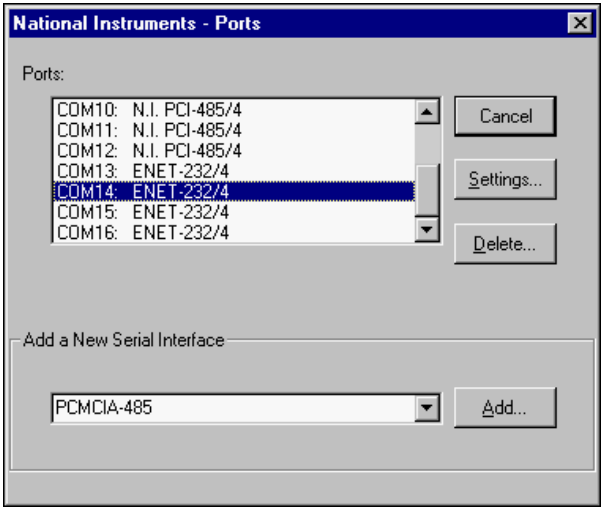


Figure 4-4. NI Ports Serial Configuration Utility

3. Select the port you want to configure and refer to the following instructions:
   - To remove hardware information about the port from Windows 2000/NT, click **Delete**.
   - To view or change the port settings, click **Settings**. A screen similar to the following appears.

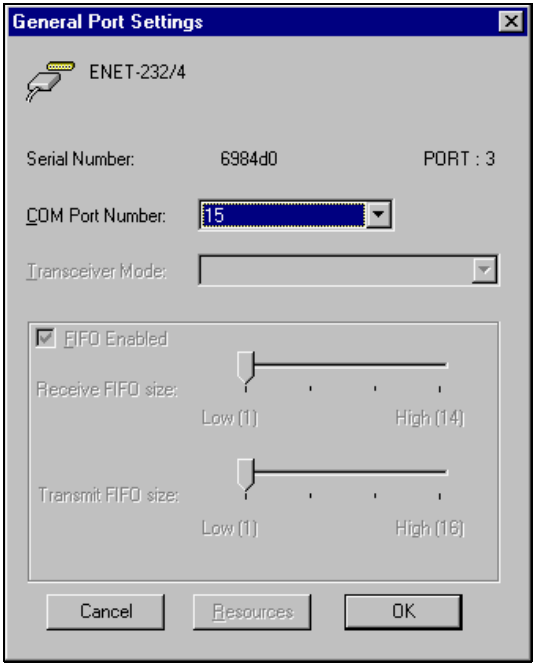


Figure 4-5. General Port Settings Window

Note The FIFO settings for serial device servers are optimized for network performance, and cannot be adjusted.

COM Port Number

Use the **COM Port Number** control to change the logical COM*x* name of the selected port.

Transceiver Mode

Use the **Transceiver Mode** list box to change the transceiver mode. This mode applies only to ENET-485 serial device servers. For more information about transceiver modes, refer to Chapter 6, *Using Your Serial Device Server*.

Linux *x*86/Solaris 2.*x*

This section describes how to use VISA Configuration to view or change the configuration of your serial ports.

1. Run `visaconf`, which is in the `NIvisa` subdirectory of your installation. A list of installed ports/devices appears.
2. Select the port you want to configure and refer to the following instructions:
   - To remove information about the port, click **Delete**.
   - To view or change the port settings, click **Edit**. A screen appears that includes five serial settings: **Baud Rate**, **Data Bits**, **Parity**, **Stop Bits**, and **Flow Control**. Modify these settings as required and click **OK** to finish. Exit **VISA Configuration**. If you see the question **`Do you wish to commit all your changes to VISA?`**, answer **Yes**.

5

Verify the Installation

This chapter describes how to verify the installation of your serial device server and the serial server software.

Running Diagnostics

Windows 2000/NT 4.0

To verify the hardware and software installation, run the Serial Device Server Diagnostics utility. Verify that no serial cables are attached to the unit and then select **Start»Programs»National Instruments Serial Server»Diagnostics**. The following screen appears. The status window is empty until you press **Start**.

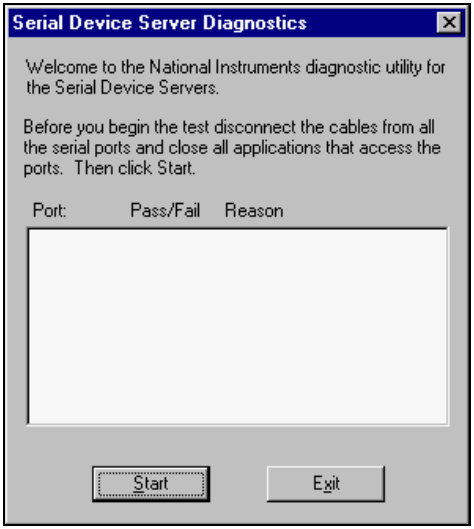

Serial Device Server Diagnostics
Welcome to the National Instruments diagnostic utility for the Serial Device Servers.
Before you begin the test disconnect the cables from all the serial ports and close all applications that access the ports. Then click Start.
Port:
Pass/Fail
Reason
Start
Exit

Figure 5-1. Serial Device Server Diagnostics Utility Before Test

When you click **Start**, the diagnostics utility verifies the following:

- The serial server software is installed properly.
- The configuration of your hardware does not conflict with anything else in your computer.
- The serial server software can communicate with your serial device server correctly.

If the test is successful, your serial device server and serial server software are installed properly. Figure 5-2 shows the results of a successful test. If the test fails, refer to Appendix C, *Troubleshooting and Common Questions*, to troubleshoot the problem.

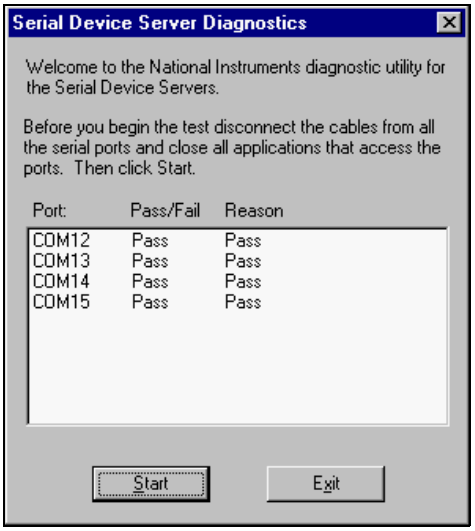

Serial Device Server Diagnostics
Welcome to the National Instruments diagnostic utility for the Serial Device Servers.
Before you begin the test disconnect the cables from all the serial ports and close all applications that access the ports. Then click Start.
Port:
Pass/Fail
Reason
COM12 Pass Pass
COM13 Pass Pass
COM14 Pass Pass
COM15 Pass Pass
Start
Exit

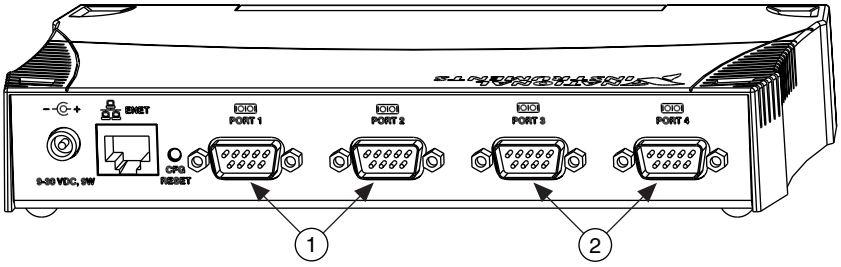
Figure 5-2. Example of Serial Device Server Diagnostics Utility After Test

Linux *x*86/Solaris 2.*x*

To verify hardware and software installation, run `NIvisaic`, which is in the `NIvisa` subdirectory of your installation. `NIvisaic` uses the VISA run-time engine to attempt to open and close each port. If the test is successful, there are no ENET-Serial ports under the **Unknown** node; they all are under the **ASRL0 (ENET/Serial)** node. Select any ENET-Serial port under the **Unknown** node and press **Enter**. This brings up a dialog box with a diagnostic message with more information on the error source. Refer to Appendix C, *Troubleshooting and Common Questions*, to troubleshoot the problem.

Connecting Serial Devices

Connect your serial devices at this time. Connect one end of the serial cable to one of the serial port connections on the rear panel of your serial device server. Connect the other end of the serial cable to your serial device. Figure 5-3 shows the location of the serial ports on a four-port serial device server.



1	Serial Ports 1 and 2	2	Serial Ports 3 and 4 (on four-port models only)

Figure 5-3. Location of Serial Ports on a Four-Port Serial Device Server

Refer to Appendix D, *Serial Port Information*, for more information about cabling specifications.

6

Using Your Serial Device Server

This chapter lists some general programming requirements and describes how to use the following various options available with your serial device server:

- Using DHCP
- Using the CFG RESET Switch
- Updating the Firmware
- Configuring Transceiver Modes on the ENET-485
- Changing the Bias Resistors on the ENET-485

General Programming Requirements

Windows 2000/NT 4.0

The serial server software is fully integrated into the standard Windows 2000/NT communications software. NI serial ports are used like any other Windows 2000/NT communications (COM) port. Windows 2000/NT has standard serial communication functions for use within either Win16 or Win32 applications. For information about Microsoft Windows serial communication functions, refer to the *Win32 Software Development Kit* and to the *Win32 Overviews* and *Win32 Reference* online help.

If you have LabVIEW, Measurement Studio, or another National Instruments application software product, and want to use it with your serial device server, refer to your product documentation for information about serial I/O functions.

Linux *x*86/Solaris 2.*x*

On Linux *x*86/Solaris 2.*x*, you can use the NI-VISA API to control the serial ports on the serial device server; NI-VISA is the National Instruments implementation of the industry-standard VISA specification. You can develop NI-VISA applications using any ANSI C compiler. The `NIvisa` subdirectory of your installation contains more information about NI-VISA.

NI-VISA also has a graphical API as part of LabVIEW, a National Instruments graphical programming environment. For Solaris, National Instruments offers LabWindows/CVI, which provides an interactive ANSI C programming environment for building virtual instrument applications. The National Instruments Web site, `ni.com`, includes more information about these environments.

Using DHCP

The Dynamic Host Configuration Protocol (DHCP) is designed for large networks in which networking devices are transient and network parameters cannot be statically assigned and thus tied to specific devices. DHCP eases the addition of networking devices onto a network by having a server assign necessary network parameters, including the IP address, netmask, and router information, to a newly attached network device. Optionally, if the device provides a hostname with the configuration request, DHCP may attempt to configure your network to recognize the device with the requested hostname.

DHCP requires a Domain Name Server (DNS) to associate the numerical IP address assigned with the requested hostname. Within the past few years, an Internet community standard has emerged to provide a standardized way for these services to provide dynamic domain name services. Using this standard, after DHCP assigns the numerical IP address, it can communicate with DNS to register the newly assigned IP address with the requested hostname. However, the complexity of DHCP and dynamic name registration typically requires active management by a corporate MIS department, or equivalent, because of several risks for failure.

One possible failure can occur if the pool of available addresses contains no more unassigned IP addresses. This problem is evident if DHCP fails to work and the **PWR/RDY** LED continues to flicker for longer than 90 seconds at power on. In this situation, you need to obtain a static IP address from your network administrator and configure the device yourself using NI Ethernet device configuration, as described in Chapter 3, *Ethernet Configuration*. Notice that if DHCP fails to assign you an address, the current subnet might not have an address available for you to use. In this case, you may need to move your product to another subnet where there is an available IP address.

Failure also happens if communication between DHCP and DNS does not occur. In this situation, DHCP assigns an address to the device, but you cannot communicate to it using the hostname you assigned. Your network administrator may need to insert the hostname manually into the DNS

table. Alternately, you can use NI Ethernet device configuration to determine the hostname associated with your assigned IP address, and change the hostname to match the DNS entry. Refer to the *Verifying the Hostname* section in Chapter 3, *Ethernet Configuration*, for more information.

Because there are many other possible reasons for failure, contact your network administrator if you are having problems getting DHCP to work. When you can use DHCP and DNS successfully, you can use the hostname form of the IP address to communicate with your product—even if the numerical IP address changes with successive reboots.

If you are setting up a small network for your instrumentation system, National Instruments recommends using static IP addresses, because they are easier to implement and maintain. In this system, you can safely use the numerical form of the IP address to communicate with your product because the address is unlikely to change. Small networks are less likely to have domain name services available that would resolve the hostname into a numerical IP address.

Using the CFG RESET Switch

The Configuration Reset (CFG RESET) switch is a recessed switch beside the Ethernet (ENET) connector on the rear panel. Refer to Figure 2-2, *Rear Panel of a Four-Port Serial Device Server*, for an illustration of its location.

This switch performs two functions, depending on whether you press it at power-on or during operation.

Using the CFG RESET Switch During Operation

While the serial device server is operational, as indicated by a steady yellow **PWR/RDY** LED, you can use the CFG RESET switch to place the box into network configuration mode.

This special mode ensures that network parameters are not changed while in normal operation mode. Because you cannot change the network parameters unless you deliberately place the serial device server into network configuration mode, the parameters are protected while in normal operation. Hosts cannot connect to the serial device server while it is in network configuration mode.

Note Pressing the CFG RESET switch has no effect if hosts are currently connected.

Close all connections, then press and hold the CFG RESET switch and wait approximately three seconds until the **PWR/RDY** LED becomes solid red. If you release the switch prior to three seconds, the serial device server continues to operate normally.

The **PWR/RDY** LED goes through the following changes during these three seconds:

1. The LED begins slowly alternating between red and yellow.
2. The alternating pattern increases in tempo.
3. At three seconds, the **PWR/RDY** LED becomes steady red. This indicates the serial device server is ready to enter network configuration mode.
4. Now release the CFG RESET switch. The **PWR/RDY** LED alternates rapidly between red and yellow to indicate the serial device server is now in network configuration mode.

This mode remains in effect until you switch off the serial device server or you use NI Ethernet device configuration to change its network characteristics.

Using the CFG RESET Switch at Power-On

In the event you forget the network configuration that a particular serial device server is using, you can reset the unit to its default network characteristics. By pressing and holding the CFG RESET switch while you power on the serial device server, the network parameters revert to the default settings as defined on the baseplate label.

You must press and hold the switch for approximately three seconds until the **PWR/RDY** LED becomes solid red. If you release the switch prior to three seconds, no change occurs to the network configuration, and the serial device server continues to boot normally.

The **PWR/RDY** LED goes through the following changes during these three seconds:

1. The LED begins slowly alternating between red and yellow.
2. The alternating pattern increases in tempo.
3. At three seconds, the **PWR/RDY** LED becomes steady red. This indicates the network configuration will be set to the factory default settings.

4. When you release the CFG RESET switch, the box continues to boot as normal, and the **PWR/RDY** LED indicates the boot process as described in Table 1-1, *LED Descriptions*.

Updating the Firmware

The serial server software contains a firmware update utility you can use to access new features that may be added to the serial device server in the future. It may be necessary to update the firmware to take advantage of these new features.

You need to know either the IP address or hostname of your serial device server before you run the NI Ethernet Device Firmware Update utility. If you do not remember this information, you can obtain it using NI Ethernet device configuration. Refer to Chapter 3, *Ethernet Configuration*, for more information.

Note The NI Ethernet Device Firmware Update utility cannot update the firmware while any network connections are active. Close any open connections before you attempt a firmware update. Hosts cannot connect to the serial device server while it is updating the firmware.

Complete the following steps to run the NI Ethernet Device Firmware Update utility.

Windows 2000/NT 4.0

1. Select **Start»Programs»National Instruments Serial Server»Firmware Update**.

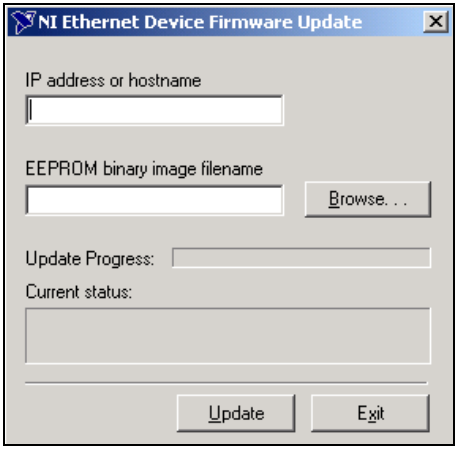


Figure 6-1. NI Ethernet Device Firmware Update Utility

2. Enter the IP address or the hostname of the serial device server in the **IP address or hostname** edit box. An example of an IP address is `137.65.220.40`. An example of a hostname is `nienetB9B76A`.
3. Enter the full path of the binary file where the firmware is located in the **EEPROM binary image filename** edit box. You also can click **Browse...** to locate the file.
4. Click **Update** to update the firmware. The NI Ethernet Device Firmware Update utility communicates with the specified serial device server to verify the box has no open network connections and determine the current version of the firmware in the unit. A dialog box reports that the update utility is searching for the Ethernet device.
5. The utility prompts you to confirm the change you are about to perform. Click **OK** to continue. As the update utility transfers the firmware image to your serial device server, the **Update Progress** status bar fills, and the **Current status** box describes each step in the process. The **Current status** box reports whether the firmware update completed successfully or failed. The serial device server automatically reboots with the new firmware in effect.

Caution Do *not* power-off the serial device server or disconnect the power supply while running the NI Ethernet Device Firmware Update utility. Doing so will damage the unit.

6. Click **Exit** to close the NI Ethernet Device Firmware Update utility.

Linux *x*86/Solaris 2.*x*

1. The firmware update utility is in the `NIserial/enet` subdirectory of your installation. Run it with the following command syntax:

   `FirmwareUpdate <EEPROM file> <host>`

   where `<EEPROM file>` is the binary file containing the new firmware image, and `<host>` is either a valid hostname or the dotted decimal numerical IP address of the device to update.
2. Follow any onscreen prompts.

Caution Do *not* power-off the serial device server or disconnect the power supply while running the firmware update utility. Doing so will damage the unit.

Configuring Transceiver Modes on the ENET-485

Note Transceiver modes apply only to the ENET-485 Series serial device server. This information is intended for advanced users.

The ENET-485 supports four modes of hardware transceiver control. You can use hardware flow control to enable and disable your transmitters and receivers so that they function on different bus topologies. Table 6-1 lists the status of the transmitters and receivers under each of the transceiver control modes.

Table 6-1. Transceiver Control Modes

Mode	Transmitter	Receiver
Four-wire mode	Always enabled	Always enabled
Two-wire mode: DTR with echo	Enabled with DTR asserted	Always enabled
Two-wire mode: DTR controlled	Enabled with DTR asserted	Enabled with DTR unasserted
Two-wire mode: Auto Control	Enabled when transmitting data	Enabled when not transmitting data

Four-Wire Mode

Use the four-wire mode for most full-duplex systems. In this mode, the transmitter and receiver are always enabled. This mode is the default.

Two-Wire Mode: DTR with Echo

Use this mode in half-duplex systems where the DTR (Data Terminal Ready) line controls the transmitter. In the DTR-with-echo mode, the transmitter is tri-stated when the DTR signal of the UART (Universal Asynchronous Receiver/Transmitter) is unasserted. To transmit, your application first must enable the transmitter by setting the DTR bit to assert DTR. After the data is fully transmitted, your application once again clears the DTR bit to disable the transmitter. Because the receiver always is enabled in this mode, you receive packets not only from other devices, but also from your transmitter.

Two-Wire Mode: DTR Controlled

This mode is similar to the two-wire, DTR-with-echo mode. Use this mode in half-duplex systems where the DTR line controls the transmitter. Although this mode uses the same method as the DTR-with-echo mode to control the transmitter, the hardware automatically disables the receiver whenever the transmitter is enabled. Thus, you do not receive the packets sent from your transmitter.

Two-Wire Mode: Auto Control

In this mode, the serial hardware transparently enables the transmitter and receiver in a two-wire system. Use this mode to remove the burden of flow control from your application. The hardware automatically enables the transmitter for each byte to be transmitted. Also, the hardware disables the receiver whenever the transmitter is enabled, so you do not receive the packets sent from your transmitter.

Note When you are communicating with a two-wire device, National Instruments recommends that you use the two-wire Auto Control mode. Because this mode handles the transmitter/receiver enabling for a two-wire connection in your hardware, it reduces the software overhead required to perform this operation in your application program.

For more information about serial communication in two- or four-wire modes, refer to the *Serial Communication Issues* section in Appendix D, *Serial Port Information*.

Setting the Transceiver Control Mode

Windows 2000/NT 4.0

To set the transceiver control mode, use the NI Ports serial configuration utility. For instructions on how to use the utility, refer to Chapter 4, *Serial Port Configuration*. The mode you select in the configuration utility is automatically configured when you open a port on a serial interface. You can also set the mode programmatically using `DeviceIoControl()`.

Setting the Transceiver Mode with DeviceIoControl()

The serial server software extends the `DeviceIoControl()` Windows function for programming the transceiver control mode. To program the transceiver control mode using `DeviceIoControl()`, complete the following steps:

1. Add the following lines to your source code:

```
#include <winioctl.h>
#define IOCTL_SERIAL_SET_TRANSCEIVER_MODE \
CTL_CODE(FILE_DEVICE_SERIAL_PORT,37, \
METHOD_BUFFERED,FILE_ANY_ACCESS)
```

2. Use the Win32 function `DeviceIoControl()`, as follows:
   a. Use the defined control code value listed in step 1 to set the transceiver mode.
   b. Use the input buffer values (unsigned long) listed in Table 6-2 for programming different transceiver modes.

Table 6-2. DeviceIoControl() Function Input Values

Transceiver Mode	`DeviceIoControl()` Function Input Value
Four-wire mode	128
Two-wire mode: DTR with echo	129
Two-wire mode: DTR controlled	130
Two-wire mode: Auto Control	131

For example, to set two-wire Auto Control mode, use the following code:

```
ULONG TranceiverMode = 131;
ULONG dummy;
DeviceIoControl(hDevice,
IOCTL_SERIAL_SET_TRANSCEIVER_MODE,(PVOID)
&TransceiverMode,sizeof(ULONG),NULL,0,&dummy,NULL);
```

Linux *x*86/Solaris 2.*x*

You can get and set Transceiver (or Wire) modes programmatically through the NI-VISA API using `viGetAttribute()` and `viSetAttribute()`. However, you cannot statically configure transceiver modes.

Controlling the Transceiver Mode Programmatically

`viGetAttribute()` and `viSetAttribute()` are documented in the NI-VISA manuals in the `NIvisa` subdirectory of your installation. Use `VI_ATTR_ASRL_WIRE_MODE`, which is documented below.

VI_ATTR_ASRL_WIRE_MODE

Resource Classes

Serial INSTR

Attribute Information

Access Privilege	Data Type	Range	Default
Read/Write Global	`ViInt16`	`VI_ASRL_WIRE_485_4` (0) `VI_ASRL_WIRE_485_2_DTR_ECHO` (1) `VI_ASRL_WIRE_485_2_DTR_CTRL` (2) `VI_ASRL_WIRE_485_2_AUTO` (3) `VI_STATE_UNKNOWN` (–1)	N/A

Description

This attribute is valid only with the RS-485 serial drivers developed by National Instruments, and sets the transceiver mode.

Table 6-3. `VI_ATTR_ASRL_WIRE_MODE` Attribute States

Transceiver Mode	`VI_ATTR_ASRL_WIRE_MODE` Attribute States
Four-wire mode	`VI_ASRL_WIRE_485_4`
Two-wire mode: DTR with echo	`VI_ASRL_WIRE_485_2_DTR_ECHO`
Two-wire mode: DTR controlled	`VI_ASRL_WIRE_485_2_DTR_CTRL`
Two-wire mode: Auto Control	`VI_ASRL_WIRE_485_2_AUTO`

For example, to set two-wire Auto Control mode, use the following code:

```
status = viSetAttribute( instr, VI_ATTR_ASRL_WIRE_MODE,
                         VI_ASRL_WIRE_485_2_AUTO );
```

Changing the Bias Resistors on the ENET-485

This section explains the functionality of the ENET-485 bias resistors and describes the method for changing them.

Functionality of Bias Resistors

A transmission line enters an indeterminate state if no nodes are transmitting on it. This indeterminate state can cause the receivers to receive invalid data bits from noise picked up on the cable. To prevent a line from receiving these data bits, force the transmission line into a known state. The ENET-485 Series contains two 620 Ω bias resistors on the transmission line. These resistors create a voltage divider that forces the voltage between the differential pair to be greater than 200 mV, the threshold voltage for the receiver.

Figure 6-2 shows a transmission line using bias resistors.

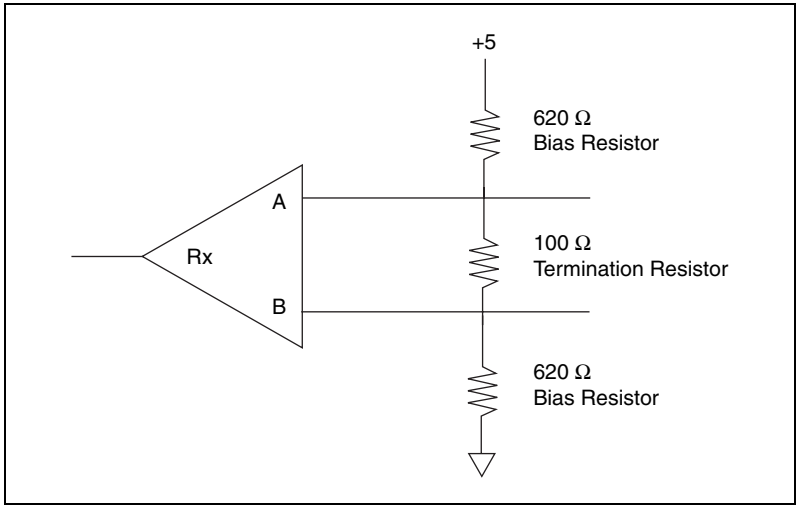


Figure 6-2. Transmission Line Using Bias Resistors

The ENET-485 Series has four user-configurable bias resistors in front of each connector. These resistors are socketed and preloaded with 620 Ω resistors. They are connected to the receive signals of each port to maintain a known state when the bus is idle. The connections are made as follows:

- RXD+ and CTS– are pulled up to VCC
- RXD– and CTS+ are pulled down to GND

Rather than using two 620 Ω resistors at one node, you can increase the value of the resistors and put them at every node. For example, if there are eight nodes in a system, you can use 4.7 kΩ resistors at each node to effectively achieve the same result.

Changing Bias Resistors

Complete the following steps to change the bias resistors on the ENET-485 Series.

1. Power off the serial device server and disconnect the cables.
2. Remove the four screws on the bottom baseplate. Slide the top cover away from the rear panel and then up, as shown in Figure 6-3.

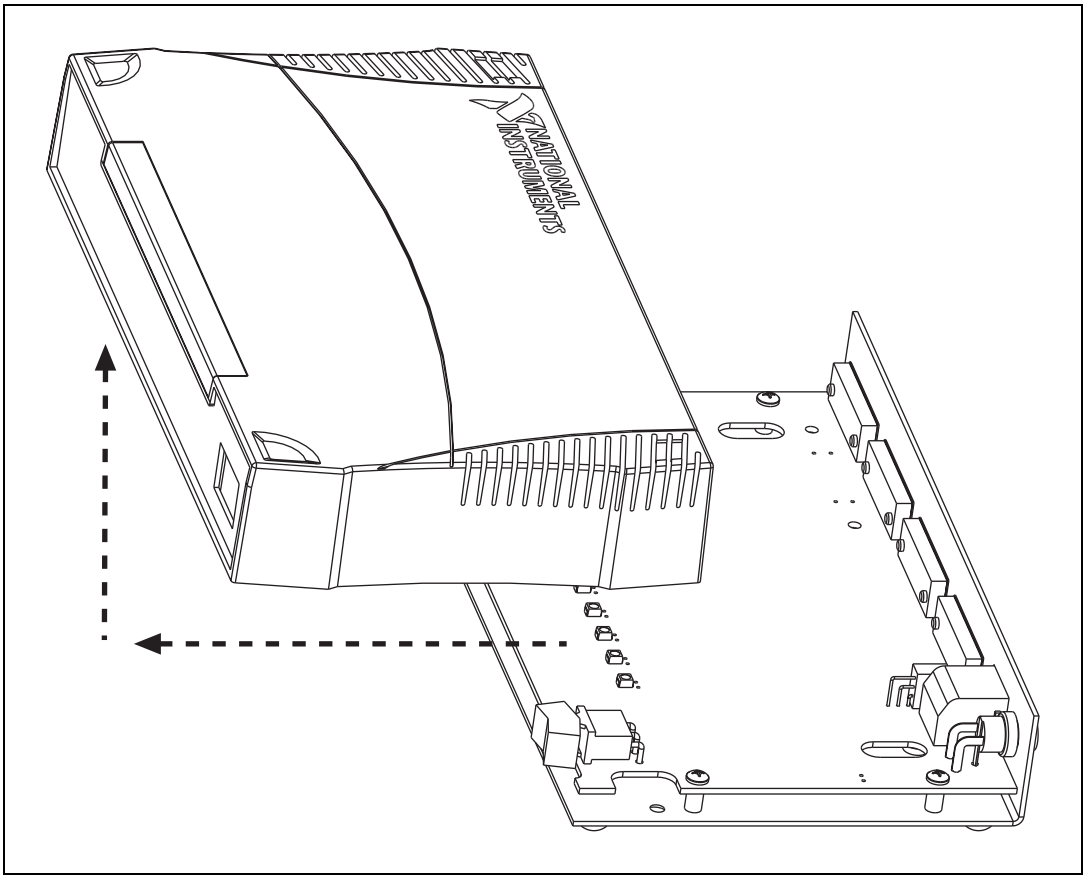


Figure 6-3. Removing the Top Cover

3. Locate the bias resistors. Figure 6-4 shows the bias resistors as black rectangles and circles. Each port has four bias resistors.

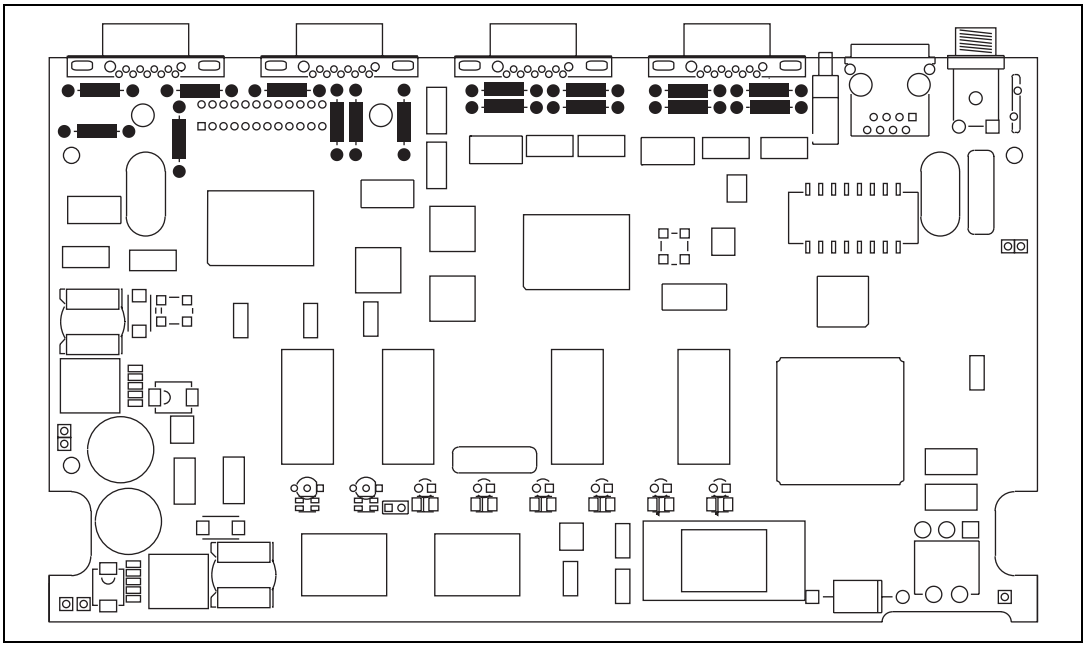


Figure 6-4. Location of Bias Resistors

4. Remove the bias resistors by gently lifting them out of the sockets.
5. Install new resistors that are trimmed to fit in the sockets.
6. Slide the top cover backwards over the baseplate and reinstall the four screws.

A

Uninstalling the Software

This appendix describes how to uninstall your serial server software.

Windows 2000/NT 4.0

1. Select **Start»Settings»Control Panel**.
2. Double-click the **Add/Remove Programs** icon. A dialog box appears with a list of the software you can uninstall. See Figure A-1 if you are using Windows 2000 or Figure A-2 if you are using Windows NT.

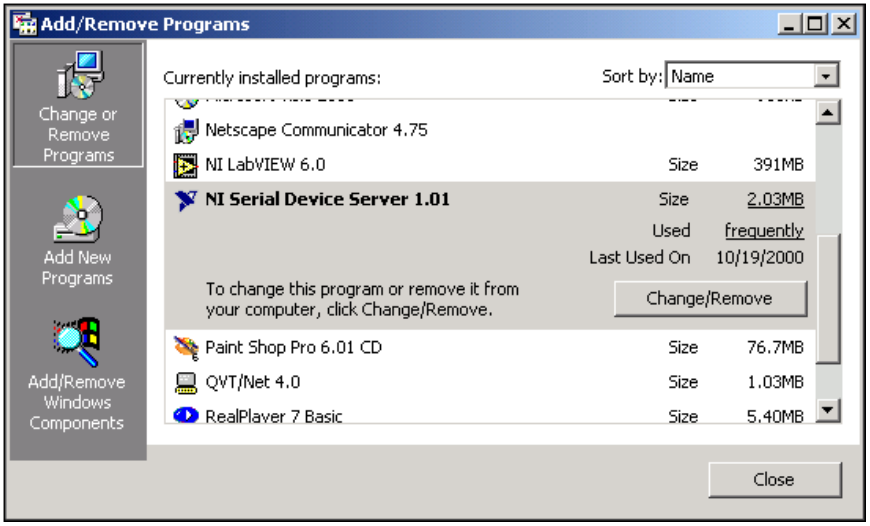


Figure A-1. Add/Remove Programs Dialog Box for Windows 2000

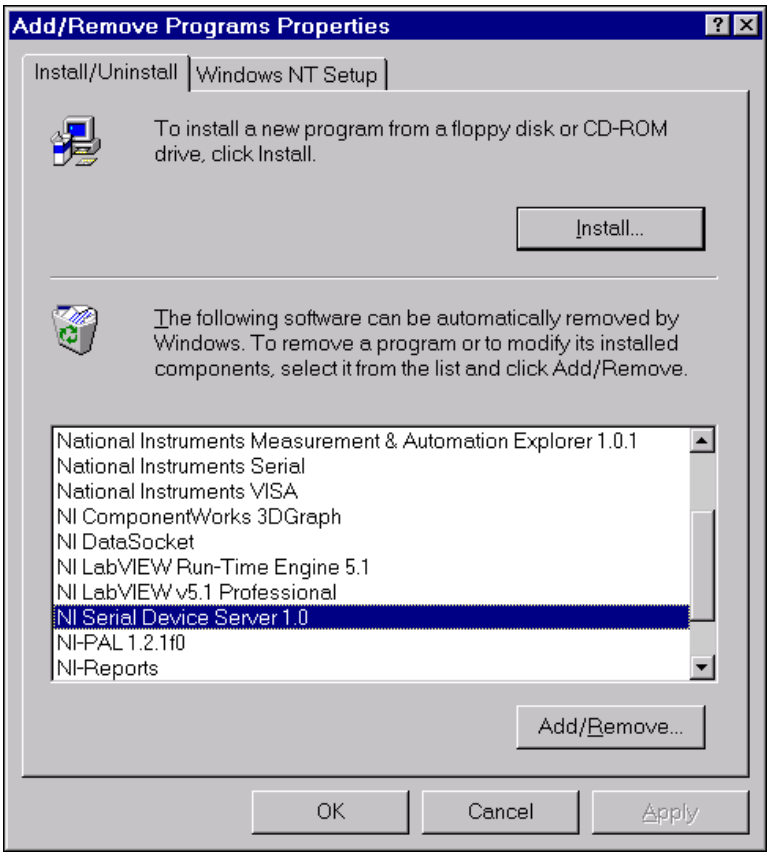

Add/Remove Programs Properties
Install/Uninstall
Windows NT Setup
To install a new program from a floppy disk or CD-ROM drive, click Install.
Install...
The following software can be automatically removed by Windows. To remove a program or to modify its installed components, select it from the list and click Add/Remove.
National Instruments Measurement & Automation Explorer 1.0.1
National Instruments Serial
National Instruments VISA
NI ComponentWorks 3DGraph
NI DataSocket
NI LabVIEW Run-Time Engine 5.1
NI LabVIEW v5.1 Professional
NI Serial Device Server 1.0
NI-PAL 1.2.1f0
NI-Reports
Add/Remove...
OK
Cancel
Apply

Figure A-2. Add/Remove Programs Dialog Box for Windows NT

3. Select the serial server software you want to uninstall and click **Change/Remove** (Windows 2000) or **Add/Remove** (Windows NT). The Uninstall program removes all folders, utilities, and registry entries associated with the serial server software. Figure A-3 shows the results of a successful uninstallation.

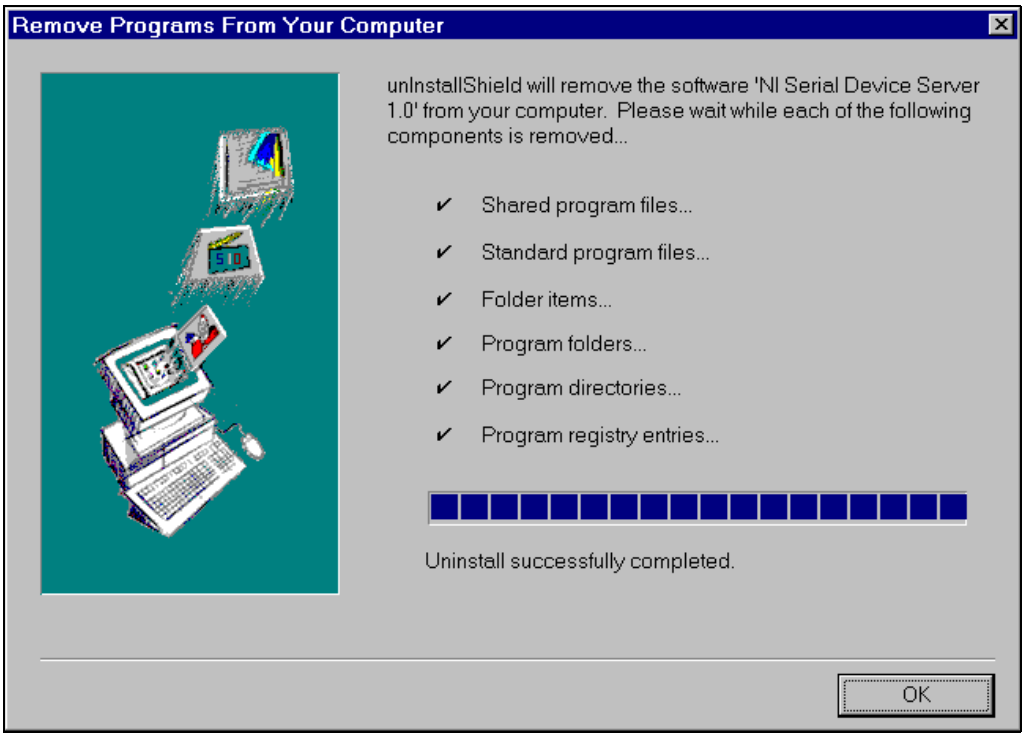

Remove Programs From Your Computer
unInstallShield will remove the software 'NI Serial Device Server 1.0' from your computer. Please wait while each of the following components is removed...
✔ Shared program files...
✔ Standard program files...
✔ Folder items...
✔ Program folders...
✔ Program directories...
✔ Program registry entries...
Uninstall successfully completed.
OK

Figure A-3. Successful Uninstallation

4. Reboot your computer if Windows 2000/NT prompts you to do so.

The uninstallation program removes only items that the setup wizard installed. If you added anything to a directory that the setup wizard created, the uninstallation program does not delete that directory. You must remove any remaining components yourself.

To reinstall the hardware and software, refer to Chapter 2, *Installation*.

Linux *x*86

If you have `rpm` install, use it to uninstall the package. Otherwise, delete the installation directory, which defaults to `/usr/local/vxipnp`).

Solaris 2.*x*

Use `pkgrm` to uninstall the package.

B

PWR/RDY LED Signaling

This appendix describes how to interpret the **PWR/RDY** LED error codes.

PWR/RDY LED Overview

The **PWR/RDY** LED has several purposes on the serial device servers. When you first power on the unit, the **PWR/RDY** LED alternates rapidly between red and yellow while it completes its power-on self-tests and acquires network parameters. When the tests complete successfully and the IP address is assigned from either nonvolatile memory or the network, the **PWR/RDY** LED remains steady yellow, indicating that the unit is ready to operate.

The **PWR/RDY** LED also alternates rapidly between red and yellow while the device is in network configuration mode. At other times, the **PWR/RDY** LED blinks slowly in a recognizable pattern to alert you of internal errors. Use this appendix to interpret and record the pattern that the **PWR/RDY** LED flashes, and then contact National Instruments.

Note By recording the **PWR/RDY** LED error messages before calling National Instruments, you can save yourself time, and customer support can answer your questions more accurately and efficiently. Do not switch off power to your serial device server before recording the flashing **PWR/RDY** LED pattern.

PWR/RDY LED signaling can report up to 81 different errors. The errors are numbered from 11 to 99 and are reported through sequences of **PWR/RDY** LED flashes.

Note There is no zero in any error message. This means that error message numbers 0–10, 20, 30, 40, 50, 60, 70, 80, and 90 are not possible.

Step 1. Count the Long Flashes

A three-second interval, during which the **PWR/RDY** LED is yellow, separates each repetition of the sequence. The sequence begins with a series of long one-second flashes—that is, one second red, one second yellow. These long flashes represent the digit in the tens column. There can be one to nine long flashes, which represent digits 1 through 9. For example, one long flash represents the digit 1 in the tens column, and nine long flashes represent the digit 9 in the tens column.

Step 2. Count the Short Flashes

The long flashes are followed by shorter flashes; each short flash lasts about one-fifth of a second—that is, one-fifth of a second red, one-fifth of a second yellow. These short flashes represent the digit in the ones column. Again, there can be one to nine flashes, which represent the digits 1 through 9. For example, one short flash represents the digit 1 in the ones column, and nine short flashes represent the digit 9 in the ones column.

Using this method, the **PWR/RDY** LED flashes the following sequence to represent error message 11:

<three seconds yellow> <one long red flash> <one short red flash> <three seconds yellow>…

The **PWR/RDY** LED flashes the following sequence to represent error message 31:

<three seconds yellow> <three long red flashes> <one short red flash> <three seconds yellow>…

Step 3. Record Your Error Message Number

When you have computed your error message number, write it down and also note the ON/OFF state of the **LINK**, **TX**, and **RX** LEDs. Have this information available when calling National Instruments.

C

Troubleshooting and Common Questions

This appendix describes how to troubleshoot problems and answers some common questions. The information in this appendix is arranged in the following sections:

- Troubleshooting Network Problems
- Troubleshooting Hardware Problems
- Troubleshooting Diagnostic Messages
- Common Questions

Troubleshooting Network Problems

My Device Does Not Appear in the NI Ethernet Device Configuration Window

- Allow at least 90 seconds after powering on the device.
- Confirm that the unit is connected to the network on the same subnet as the host computer.
- Click **Refresh** on the utility window to update the current network information.
- Refer to Chapter 3, *Ethernet Configuration*, for more information about NI Ethernet device configuration.

Network Has DHCP But Does Not Configure The Device's Network Parameters

- Use NI Ethernet device configuration to confirm that your device is set to use DHCP.
- Have your network administrator confirm that your network's DHCP server is functional and that there are available IP addresses.

Cannot Change Network Settings

- Verify there are no open network connections. All port LEDs should be off.
- Confirm the device is in network update mode. If the **PWR/RDY** LED is not alternating rapidly between red and yellow, press and hold the CFG RESET switch for three seconds to enter network update mode. For more information, refer to the *Using the CFG RESET Switch* section in Chapter 6, *Using Your Serial Device Server*.

Cannot Access Device When Using Hostname

- If you want to use the same hostname that the device is configured with and you know its IP address, skip to the next bullet. Otherwise, run NI Ethernet device configuration. (You must use a computer on the same subnet as the device.) Refer to Chapter 3, *Ethernet Configuration*, for more information about NI Ethernet device configuration.
- Verify the device is present on the network by pinging the IP address of your device. Ping is a network utility that sends a packet to a device/host on the network, then waits for it to be echoed back, which indicates an active device/host. Find the directory where `ping` is installed and type in the following command:

  `ping IPaddress`

  where *IPaddress* is the IP address assigned to your serial device server. When your device responds to the ping requests, repeat this procedure but this time using the hostname:

  `ping hostname`
- If your device fails to respond when using the hostname, the DNS entry for the device is incorrect.
- If the network parameters were statically (manually) assigned, the hostname must be manually entered in your network's Domain Name Server (DNS) table before you can use the hostname to communicate with your device. Have your network administrator enter this information.
- You also can manually check that the device's hostname has been entered in the DNS table by using NSLookup. This network utility queries the DNS for entries in the DNS table. You can use NSLookup to determine the hostname associated with any particular IP address listed in the DNS table. Find the directory where `nslookup` is installed and type in the following command:

  `nslookup IPaddress`

where *IPaddress* is the IP address you want to look up.

Alternatively, to determine the IP address associated with a particular hostname, type in the following command instead:

`nslookup hostname`

If you still cannot communicate with your device, contact National Instruments.

Cannot Communicate with Devices Located on Other Subnets

- Verify that the device is present on the network by pinging the IP address of your device. Find the directory where `ping` is installed and type in the following command:

  `ping IPaddress`

  where *IPaddress* is the IP address assigned to your serial device server.
- Confirm that the gateway settings of the device are set properly. To do this, run NI Ethernet device configuration on a computer on the same subnet as the device.
- Confirm that the gateway settings of the host machine are set properly.

  (Windows 2000/NT 4.0 only) To view your network settings, find the directory where `ipconfig` is installed and run it.

  If you need more information, you can run `ipconfig` with the `/all` option by typing `ipconfig /all`. This shows you all settings for the Windows 2000/NT machine. Be sure to use the settings for the Ethernet adapter you are using to communicate with the serial device server.

  (Linux x86/Solaris 2.x only) To view your network settings, find the directory where `ifconfig` is installed and run it; you may need to use `-a` as a flag. Be sure to use the settings for the Ethernet adapter you are using to communicate with the serial device server.

Troubleshooting Hardware Problems

Unit Does Not Power On

Verify that the external power supply is securely fastened to the device and the power supply is plugged into an outlet of proper voltage and the power switch is in the ON position.

PWR/RDY LED Continues to Flash after 90 Seconds

If the **PWR/RDY** LED continues to flash rapidly 90 seconds after power-on, the serial device server cannot obtain its network parameters from the network using DHCP. In this case, have your network administrator verify your network parameters.

PWR/RDY LED is Steady Red

Verify that the CFG RESET button is not pressed or stuck. If the LED remains red, the device encountered an unrecoverable error. Contact National Instruments.

Ethernet LEDS (LINK, TX, and RX) Are Blinking in Unison

An internal network configuration error has occurred. Contact National Instruments.

Serial Application Cannot Open Port

- Confirm that no other users or applications are already using the port. The port is closed when its associated port LED is off.
- Verify that the device is not in network configuration mode or in the process of booting (indicated by the rapid blink of the **PWR/RDY** LED).
- Verify that the system is properly configured. Run diagnostics as described in Chapter 5, *Verify the Installation*.

Cannot Send/Receive Data or Serial Data is Scrambled

- Verify that the baud rate, data bits, stop bits, and parity settings are correct for both the serial device server and the target device.
- Confirm you are using the correct serial cable type (null modem or straight-through; RS-232 or RS-485).
- If you are using an ENET-485, confirm that you are using the proper wire mode and bus configuration. Refer to the *Configuring Transceiver Modes on the ENET-485* section in Chapter 6, *Using Your Serial Device Server*, for more information on the ENET-485 wire modes.

Troubleshooting Diagnostic Messages

This section lists the possible diagnostic messages, along with solutions for the detected errors.

Windows 2000/NT 4.0

Environment is not configured properly

This error message occurs if the Serial Device Server Diagnostics utility detected a problem with the operating system environment variables associated with the Windows path. Contact your network administrator to correct this problem.

Required file [filename] is missing

This error message occurs if a critical system file could not be found. Reinstall the serial server software for Windows 2000/NT to replace the missing files, as described in Chapter 2, *Installation*.

Error reading registry

This error message occurs if a problem was detected with the Windows registry keys associated with the serial device server. Complete the following steps to recreate the required keys:

1. Open the NI Ports utility. Select **Start»Settings»Control Panel» NI Ports**.
2. Add the serial device server(s) you want to use with your system as described in the *Adding a New Serial Interface* section in Chapter 4, *Serial Port Configuration*.
3. Reboot your computer for the new registry settings to take effect.

Failed to open network connection

This error message occurs if the Serial Device Server Diagnostics utility detected a problem with your computer's network connection. First, verify that you have a Network Interface Card (NIC) properly installed in your computer. Next, complete the following steps to verify that the TCP/IP protocol is properly configured on your computer. Follow the procedure specific to either Windows 2000 or Windows NT.

Windows 2000 Complete the following steps:

1. Select **Start»Settings»Control Panel»Network and Dial-up connections»Local Area Connection**.
2. Click **Properties**.
3. Double-click **Internet Protocol (TCP/IP)** in the components list.

Note If **Internet Protocol** is missing from the list, click **Install**, select **Protocol**, and then click **Add**. Select **Internet Protocol (TCP/IP)** from the list of available protocols, and then click **OK**.

4. Verify that each of the network settings listed in the Internet Protocol (TCP/IP) Properties window matches the settings recommended by your network administrator. Also, click **Advanced** and verify the additional settings.

Windows NT Complete the following steps:

1. Select **Start»Settings»Control Panel»Network**.
2. Select the **Protocols** tab.
3. Double-click **TCP/IP Protocol** in the **Network Protocols** list.

Note If **TCP/IP Protocol** is missing from the list, click **Add**, select **TCP/IP Protocol** from the list of available protocols, and then click **OK**.

4. Verify that each of the network settings listed in the Microsoft TCP/IP Properties window matches the settings recommended by your network administrator.

Could not connect to Serial Device Server

This error message occurs if a problem is encountered while attempting to communicate with the serial device server.

- Confirm the serial device server is turned on.
- Make sure the serial device server is properly configured. Refer to the *Installing the Serial Device Server* section in Chapter 2, *Installation*, for detailed instructions.
- You may be using the incorrect Ethernet cable to connect to the serial device server. If the serial device server is connected directly to a network interface card (NIC), use an Ethernet crossover cable. Use an Ethernet straight-through cable if the serial device server is connected to a network hub.

- Check that the serial device server is connected to the network and the **LINK** LED is lit.
- Verify that the hostname is correctly entered in the DNS table. For more information, refer to the *Cannot Access Device When Using Hostname* topic, earlier in this appendix.
- If the serial device server is located on a different subnet, refer to the *Cannot Communicate with Devices Located on Other Subnets* topic, earlier in this appendix.

Serial Device Server refused request

This error message occurs if the serial device server is unable to process a diagnostics command. The most likely cause of this problem is that a serial port is open by another user or application. Close all serial ports and run the diagnostics program again. All serial ports are closed if all port LEDs are off.

Could not directly access the serial port

This error message occurs in response to an error with the serial device server. Reboot the serial device server and run the diagnostics program again. If this problem persists, contact National Instruments.

Could not locally access the serial port

This error message occurs in response to an error with the Windows 2000/NT driver. Reinstall the software as described in Chapter 2, *Installation*, and try the diagnostics program again. If this problem persists, contact National Instruments.

Linux *x*86/Solaris 2.*x*

VI_ERROR_RSRC_NFOUND

This error message occurs if a problem is encountered while attempting to communicate with the serial device server.

- Confirm the serial device server is turned on.
- Make sure the serial device server is properly configured. Refer to the *Installing the Serial Device Server* section in Chapter 2, *Installation*, for detailed instructions.
- You may be using the incorrect Ethernet cable to connect to the serial device server. If the serial device server is connected directly to a network interface card (NIC), use an Ethernet crossover cable. Use an

Ethernet straight-through cable if the serial device server is connected to a network hub.

- Check that the serial device server is connected to the network and the **LINK** LED is lit.
- Verify that the hostname is correctly entered in the DNS table. For more information, refer to the *Cannot Access Device When Using Hostname* topic, earlier in this appendix.
- If the serial device server is located on a different subnet, refer to the *Cannot Communicate with Devices Located on Other Subnets* topic, earlier in this appendix.

VI_ERROR_RSRC_BUSY

This error message occurs if the serial device server is unable to process a diagnostics command. The most likely cause of this problem is that a serial port is open by another user or application. Close all serial ports and run the diagnostics program again. All serial ports are closed if all port LEDs are off.

Common Questions

Windows 2000/NT 4.0

How can I determine which type of serial hardware I have installed?

(Windows 2000) To display a list of all installed communication ports, right-click **My Computer**, and select **Properties**. Under the **Hardware** tab, select **Device Manager**. All installed serial ports are listed under **Ports**.

(Windows NT) To display a list of all installed communication ports, select **Start»Settings»Control Panel»Ports**. To display a list of installed National Instruments serial ports, select **Start»Settings»Control Panel» NI Ports**.

How can I determine which version of the serial server software I have installed?

The `Readme.txt` file included with the serial server software for Windows 2000/NT gives the version of the software. To open the file, select **Start»Programs»National Instruments Serial Server»Readme.txt**.

How can I determine which version of firmware is running on my serial device server?

Use the NI Ethernet Device Configuration utility to view the firmware version of the serial device server. Complete the following steps:

1. Verify that the specific serial device server is located on the same subnet as your computer.
2. Select **Start»Programs»National Instruments Serial Server»Ethernet Device Configuration**.
3. Select your serial device server and then click **Properties…**. The firmware version is listed in the Properties window.

How can I determine which port is associated with COM*x*?

(Windows 2000) To determine which physical port is associated with COM*x*, right-click **My Computer** and select **Properties**. Under the **Hardware** tab, select **Device Manager**. All installed serial ports and their associated physical ports are listed under **Ports**. For all serial device servers, PORT 1 refers to the port next to the RJ-45 Ethernet connector, PORT 2 refers to the next adjacent port, and so on.

(Windows NT) To determine which physical port is associated with COM*x*, complete the following steps:

1. Select **Start»Settings»Control Panel»NI Ports**.

   A list of installed National Instruments ports with their logical COM*x* names appears. If the COM ports associated with a particular serial device server are missing from this list, refer to the *Adding a New Serial Interface* section in Chapter 4, *Serial Port Configuration*, to add the serial device server COM ports to your computer.
2. Select a COM port and click **Settings**.

   The General Port Settings dialog box displays information that identifies the serial interface associated with this COM port. For all serial device servers, PORT 1 refers to the port next to the RJ-45 Ethernet connector, PORT 2 refers to the next adjacent port, and so on.

How can I name National Instruments serial ports COM1, COM2, COM3, or COM4?

(Windows 2000) Complete the following steps:

1. Right-click **My Computer** and select **Properties**. Under the **Hardware** tab, select **Device Manager**.
2. Verify that no local ports are already assigned to the COM number(s) you want to use. If they are, use the following procedure to reassign these ports:
   a. Right-click the local COM port you want to reassign from the list of installed serial ports.
   b. From the **Port settings** tab, click **Advanced...**.
   c. Change the COM port number to a new value.
3. After you reassign all local ports, close the Device Manager.
4. Select **Start»Settings»Control Panel»NI Ports**.
5. Select the NI-Serial port you want to rename.
6. Click **Settings**.
7. Change the COM port number to a new value.

(Windows NT) Complete the following steps:

1. Select **Start»Settings»Control Panel»Ports**.
2. Verify that no local ports are already assigned to the COM number(s) you want to use. If they are, use the following procedure to reassign these ports:
   a. Select the local COM port you want to reassign from the list of installed serial ports.
   b. Click **Settings**.
   c. Click **Advanced**.
   d. Change the COM port number to a new value.
3. After you reassign all local ports, close Ports.
4. Select **Start»Settings»Control Panel»NI Ports**.
5. Select the NI-Serial port you want to rename.
6. Click **Settings**.
7. Change the COM port number to a new value.

Why does the Device Manager report there is no driver installed for remote serial ports?

(Windows 2000 only) This is normal for serial device server ports. Because the serial device server is installed separately, the Device Manager does not display its information.

Why can't I configure remote serial ports directly from the Device Manager?

(Windows 2000 only) The remote serial ports are listed in the Device Manager for informational purposes only. To change the configuration information of a serial device server port, use the NI Ports integrated control panel. For more information on NI Ports, refer to Chapter 4, *Serial Port Configuration*.

I changed the hostname and/or IP address of my serial device server. Why can I no longer communicate with my devices?

You must update the serial device server configuration information in NI Ports.

1. Select **Start»Settings»Control Panel»NI Ports**.
2. Select the serial ports associated with the serial device server that you reconfigured and click **Delete**.
3. Add the serial ports back to your system using the updated hostname and/or IP address. For more information, refer to the *Adding a New Serial Interface* section in Chapter 4, *Serial Port Configuration*.
4. Reboot your computer for the changes to take effect.
5. Run the Serial Device Server Diagnostics utility as described in Chapter 5, *Verify the Installation*.

Why does the CreateFile API fail when I try to open a serial port that is assigned COM12 on the serial device server?

The `CreateFile` function from the Microsoft Win32 API fails for port names COM10 and higher. To use these ports successfully with this function, append the string `\\.\` before the port name. For example, when using the C programming language to open COM12, use the following string for the port name:

```
"\\\\.\\COM12"
```

What is the maximum baud rate supported and how can I set it?

The maximum baud rate supported is 460.8 kbits/s for RS-485 and 230.4 kbits/s for RS-232. To set the baud rate, use the `SetCommState` Win32 function and pass the actual value of the baud rate in the **BaudRate** field of the **DCB** structure.

My application worked with a board interface, but it times out when I use the serial device server interface. What should I do?

Because the serial device server is a network device, it is dependent on network conditions for timely communications. An unpredictable delay is associated with using the remote serial ports. Applications may require longer serial timeouts to compensate for this delay. However, different applications handle serial timeouts differently, and each must be adjusted individually to account for your network conditions.

What do I do if the Serial Device Server Diagnostics utility fails with an error?

Refer to the troubleshooting sections of this appendix for specific information about what might cause the diagnostics utility to fail. If you have already completed the troubleshooting steps, contact National Instruments.

How many serial interfaces can I configure for use with my serial server software for 2000/NT?

Currently, the serial server software for 2000/NT can be configured to communicate with up to 256 serial ports.

How do I communicate with my instrument over the serial bus?

Refer to the documentation that came from the instrument manufacturer. The command sequences you use are dependent on the specific instrument. The documentation for each instrument should include the serial commands you need to communicate with it.

Why does the uninstall program leave some components installed?

The Uninstall program removes only items that the installation program installed. If you add anything to a directory that the installation program created, the Uninstall program does not delete that directory, because the directory is not empty after the uninstallation. You will need to remove any remaining components yourself. Also, reboot your computer after running the Uninstall program if prompted by Windows 2000/NT.

I installed or uninstalled NI-Serial software for Windows NT, and NI Ports no longer supports the serial device server devices or is missing. What should I do?

(Windows NT only) NI Ports is a shared utility with both NI-Serial (PCI, AT, and PCMCIA products) and NI-Serial server (serial device server products). The most current version of NI Ports must be installed to support both product lines. To restore NI Ports, reinstall the NI-Serial device server software as described in Chapter 2, *Installation*. You do not need to reinstall the serial device server devices, as their configuration information should be intact.

Can I use the serial device server with older Win16 serial applications?

Yes, if the application uses standard Win16 API function calls. While the serial device server uses the Win32 API, Windows automatically translates the Win16 API calls into Win32 API calls with Windows On Windows (WOW). As a result, Win16 applications running in a Win32 environment can use the serial device server.

Can I use the serial device server with DOS serial applications?

No. Because the serial device server driver uses the Windows API, DOS serial applications will not work. DOS understands only that COM1 is mapped to base address 3f8, COM2 is mapped to 2f8, and so on. Because no physical memory addresses are associated with serial device server ports, DOS serial applications are unable to access the serial device server.

I powered off my serial device server before recording the flashing PWD/RDY LED pattern. What should I do?

Try to duplicate the error before calling National Instruments for assistance. Recording the **PWR/RDY** LED pattern is not critical to the operation of your serial device server, but it saves you time and helps National Instruments to diagnose the problem quickly and accurately.

Why does NI Ethernet device configuration list my box as `*BUSY*` when I know my network uses DHCP?

For up to one minute, the serial device server attempts to retrieve network parameters from a DHCP server. During this time, **`*BUSY*`** appears in the utility display. If this status does not change, there are several reasons why DHCP may fail to respond. One of the most likely reasons is that your subnet has no more available addresses to assign using DHCP. Please consult your network administrator to determine the specific reason for the problem.

I just added a serial device server to the network, but it does not show up in NI Ethernet device configuration. What is the problem?

Allow at least 15 seconds for the serial device server to complete its power-on self tests before launching device configuration or clicking **Refresh**.

Communication between NI Ethernet device configuration and the serial device server is not guaranteed. Though unlikely, it is possible that the communication gets lost in the network. Click **Refresh** more than once before concluding the device is not discovered.

Verify that the serial device server shares the same subnet as the computer running NI Ethernet device configuration. NI Ethernet device configuration cannot communicate with devices through gateways on the network and will not discover devices on another subnet.

Linux *x*86/Solaris 2.*x*

How can I determine which version of the serial server software I have installed?

The `Readme.txt` file in the `NIvisa` subdirectory of your installation gives the software version.

How can I determine what ports I have installed?

Run `visaconf`, which is in the `NIvisa` subdirectory of your installation. You will see all previously configured ENET-Serial ports under the **Ethernet Serial** node. However, not all the ports may be ready for use. The next question and answer explain how to determine whether ports are ready for use.

How can I determine which ports are ready for use?

Run `NIvisaic`, which is in the `NIvisa` subdirectory of your installation. All ports that are ready for use will appear under the **ASRL0 (ENET/Serial)** node. Any unready ports will appear under the **Unknown** node. For more information, refer to the *Running Diagnostics* section in Chapter 5, *Verify the Installation*.

How many ports can I use simultaneously?

You can use up to 256 VISA resources simultaneously.

How can I determine which firmware version is running on my serial device server?

Use NI Ethernet device configuration to view the firmware version of the serial device server. Complete the following steps:

1. Verify that the specific serial device server is on the same subnet as your computer.
2. Run `visaconf`, which is in the `NIvisa` subdirectory of your installation. Click on **Add Static**, which brings up the **Add New Static Resource** window. From the **Select the interface** listbox, click **NI ENET Serial Box**. from the right pane, click **Browse…** to bring up the **NI Ethernet Device Configuration** window.
3. Select your serial device server and then click **Properties**. The firmware version is listed in the Properties window.

What is the maximum baud rate supported?

The maximum baud rate supported is 460.8 kbits/s for RS-485 and 230.4 kbits/s for RS-232.

My application worked with a board interface, but it times out when I use the serial device server interface. What should I do?

Because the serial device server is a network device, it is dependent on network conditions for timely communications. An unpredictable delay is associated with using the remote serial ports. Applications may require longer serial timeouts to compensate for this delay. However, different applications handle serial timeouts differently, and each must be adjusted individually to account for your network conditions.

What do I do if diagnostics shows errors?

Refer to the troubleshooting sections of this appendix for specific information about what might cause diagnostics to show errors. If you already have completed the troubleshooting steps, contact National Instruments.

How do I communicate with my instrument over the serial bus?

Refer to the documentation that came from the instrument manufacturer. The command sequences you use are dependent on the specific instrument. The documentation for each instrument should include the serial commands you need to communicate with it.

I powered off my serial device server before recording the flashing PWD/RDY LED pattern. What should I do?

Try to duplicate the error before calling National Instruments for assistance. Recording the **PWR/RDY** LED pattern is not critical to the operation of your serial device server, but it saves you time and helps National Instruments to diagnose the problem quickly and accurately.

Why does NI Ethernet device configuration list my box as `*BUSY*` when I know my network uses DHCP?

For up to one minute, the serial device server attempts to retrieve network parameters from a DHCP server. During this time, **`*BUSY*`** appears in the utility display. If this status does not change, there are several reasons why DHCP may fail to respond. One of the most likely reasons is that your subnet has no more available addresses to assign using DHCP. Please consult your network administrator to determine the specific reason for the problem.

I just added a serial device server to the network, but it does not show up in NI Ethernet device configuration. What is the problem?

Allow at least 15 seconds for the serial device server to complete its power-on self tests before launching device configuration or clicking **Refresh**.

Communication between NI Ethernet device configuration and the serial device server is not guaranteed. Though unlikely, it is possible that the communication gets lost in the network. Click **Refresh** more than once before concluding the device is not discovered.

Verify that the serial device server shares the same subnet as the computer running NI Ethernet device configuration. NI Ethernet device configuration cannot communicate with devices through gateways on the network and will not discover devices on another subnet.

D

Serial Port Information

This appendix describes the RS-232, RS-422, and RS-485 standards and explains some of the issues involved with these types of serial communication.

Table D-1 lists the features of the RS-232, RS-422, and RS-485 standards.

Table D-1. RS-232, RS-422, and RS-485 Features

Feature	RS-232	RS-422	RS-485
Type of transmission lines	Unbalanced	Differential	Differential
Maximum number of drivers	1	1	32
Maximum number of receivers	1	10	32
Maximum cable length	50 ft.	4,000 ft.	4,000 ft.
Maximum data rate	330 kbits/s	10 Mbits/s	10 Mbits/s
Maximum CMV	± 25 V	±7 V	+12 to –7 V
Driver output	5 to 25 V	2 to 6 V	1.5 to 6 V
Driver load	> 3 kΩ	100 Ω	60 Ω

RS-232

As specified in the ANSI/EIA-232-D Standard, *Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*, RS-232 standardizes serial communication between computers, and between computer terminals and modems. Many applications use the RS-232 standard to interface peripherals to personal computers. RS-232 uses transmission lines in which the state of each signal is represented by referencing the voltage level of a single line to ground. RS-232 was designed for serial communication up to

distances of 50 ft. and with data rates up to 20 kbits/s. However, because of improvements in line drivers and cabling, you can usually increase the actual performance of the bus past the limitations on speed and distance recommended in the specification.

RS-422

As specified in the EIA/RS-422-A Standard, *Electrical Characteristics of Balanced Voltage Digital Interface Circuits*, RS-422 defines a serial interface much like RS-232. However, RS-422 uses balanced (or differential) transmission lines. Balanced transmission lines use two transmission lines for each signal. The state of each signal is represented, not by a voltage level on one line referenced to ground as in RS-232, but rather by the relative voltage of the two lines to each other. For example, the TX signal is carried on two wires, wire A and wire B. A logical 1 is represented by the voltage on line A being greater than the voltage on line B. A logical 0 is represented by the voltage on line A being less than the voltage on line B. Differential voltage transmission creates a signal that is more immune to noise as well as voltage loss due to transmission line effects. Thus, you can use RS-422 for longer distances (up to 4,000 ft.) and greater transmission speeds (up to 10 Mbits/s) than RS-232.

RS-485

As specified in the EIA-485 Standard, *Standard for Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems*, RS-485 expands on the RS-422 standard by increasing the number of devices you can use from 10 to 32 and by working with half-duplex bus architectures. Unlike the RS-422 standard, RS-485 addresses the issue of using multiple transmitters on the same line. RS-485 defines the electrical characteristics necessary to ensure adequate signal voltages under maximum load and short-circuit protection. RS-485 can also withstand multiple drivers driving conflicting signals at the same time.

Serial Communication Issues

This section explains some serial communication issues, including duplex architectures, termination methods, bias resistors, and types of connecting equipment.

Duplex Architectures

Duplex refers to the means of bandwidth usage in a serial system. The two common means of bi-directional serial communication are full duplex and half duplex. Half-duplex communication involves a transmitter and a receiver connected to each end of the same wire or pair of wires. Because the same transmission line both sends and receives data, devices cannot send data in both directions at the same time. First, one device transmits over the wire(s) to the receiver of the second device. When the first device finishes transmitting, both devices switch the connections from their transmitter to their receiver, or vice versa. The device that was receiving data can then transmit over the line.

In full-duplex communication, the devices use a separate wire (or pair of wires) for simultaneous transmission in each direction. Thus, the devices do not switch between transmitting and receiving.

In a differential serial bus (such as RS-422 or RS-485), a half-duplex system transmits and receives over the same twisted pair of wires. Thus, half-duplex communication is often referred to as *two-wire* communications. Likewise, full-duplex communication is often referred to as *four-wire* communications, because the full-duplex system uses a separate pair of wires for communication in each direction.

Full Duplex

A typical full-duplex multidrop bus architecture involves a master-slave protocol. Only one device, the master, can control access to the bus. All other devices are slaves. Slave devices must wait for the master to give them access to the bus. In a typical full-duplex system, one transmission line connects the bus master transmitter to all of the slave receivers. A second transmission line connects all of the slave transmitters to the bus master receiver.

Figure D-1 shows a typical full-duplex system.

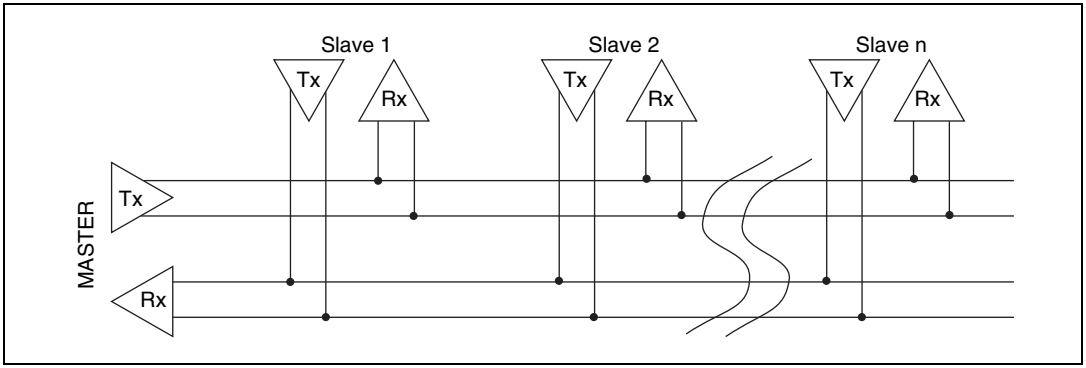


Figure D-1. Typical Full-Duplex System

Half Duplex

A typical half-duplex multidrop bus architecture also involves a master-slave protocol. However, in a half-duplex system, all transmitters and receivers are connected to the same transmission line.

Figure D-2 shows a typical half-duplex system.

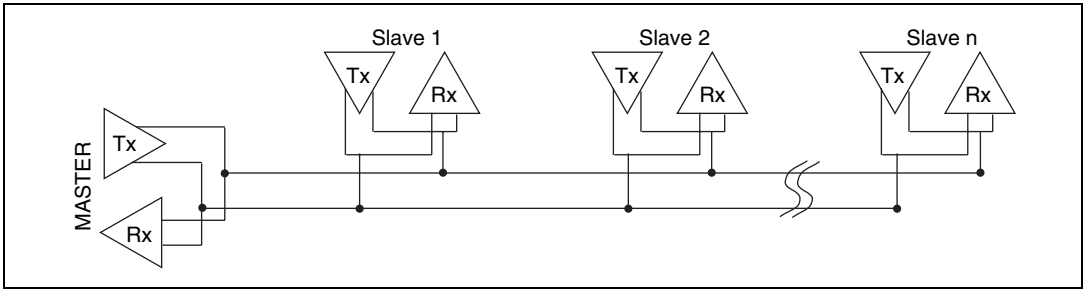


Figure D-2. Typical Half-Duplex System

Termination

Because each differential pair of wires is a transmission line, you must properly terminate the line to prevent reflections. A common method of terminating a two-wire multidrop RS-485 network is to install terminating resistors at each end of the multidrop network. If you daisy-chained multiple instruments together, you need a terminating resistor at only the first and last instruments. The terminating resistor should match the characteristic impedance of the transmission line (typically 100 to 120 Ω). You can order an optional DB-9 RS-485 termination connector that contains embedded terminating resistors for easy termination from National Instruments. For ordering information, contact National Instruments.

Figure D-3 shows a multidrop network using terminating resistors.

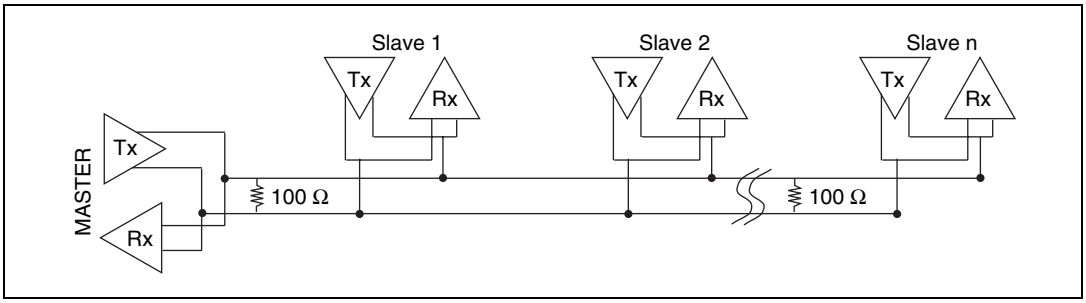


Figure D-3. Multidrop Network Using Terminating Resistors

DTE vs. DCE

In the RS-232 specification, DTE (Data Terminal Equipment) and DCE (Data Communications Equipment)[1] refer to the types of equipment on either end of a serial connection. In general, DTE and DCE refer to computer equipment and modems, respectively. Because the RS-232 specification mainly involves connecting a DTE directly to a DCE and vice versa, the pinouts are defined so that cabling is simple. That is, a cable connects a computer to a modem by wiring pin 1 to pin 1, pin 2 to pin 2, and so on. This method is known as *straight-through* cabling.

Figure D-4 shows straight-through cabling in a DTE-to-DCE interface.

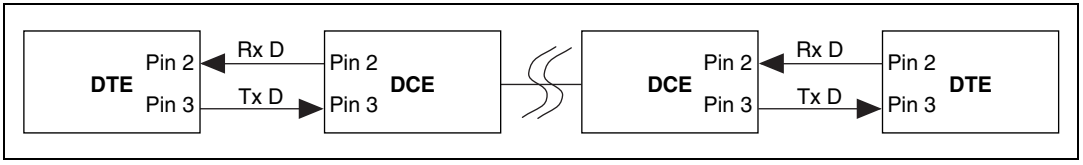


Figure D-4. Straight-Through Cabling in a DTE-to-DCE Interface

Straight-through cabling is still the standard method to connect a modem to your PC. However, because many applications use serial communication to connect two or more DTEs without modems, the cabling becomes more complicated. If two DTEs are wired together using a straight-through cable, one transmitter is connected to the other transmitter, and one receiver is connected to the other receiver. In this setup, no transmissions can occur. Thus, these applications must use a cabling scheme that connects the transmitter on one device to the receiver on the other device and vice versa. This method is known as *null-modem* cabling, because it replaces the two modems that traditional RS-232 applications would require between the two DTEs. To communicate from one DTE serial port to another, use a null-modem cable.

Figure D-5 shows null-modem cabling in a DTE-to-DTE interface.

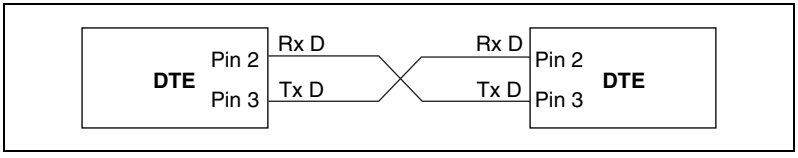


Figure D-5. Null-Modem Cabling in a DTE-to-DTE Interface

[1] In Revision D of the RS-232 specification, a DCE is a Data Circuit-Terminating Equipment.

Cable Connections

This section describes the cable connectors on your serial device server.

DB-9 Connector

Figure D-6 and Table D-2 give the pin locations and descriptions of the DB-9 connector.

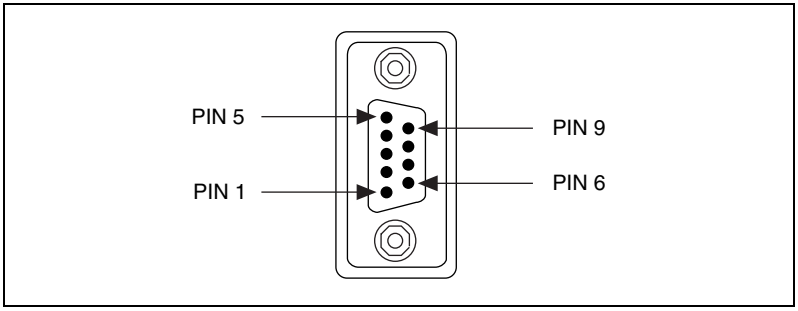


Figure D-6. DB-9 Connector Pin Locations

Table D-2. DB-9 Pin Descriptions

DB-9 Pin	232 Signal	485 Signal
1	DCD	GND
2	$\overline{\text{RXD}}$	CTS+ (HSI+)
3	$\overline{\text{TXD}}$	RTS+ (HSO+)
4	DTR	RXD+
5	GND	RXD–
6	DSR	CTS– (HSI–)
7	RTS	RTS– (HSO–)
8	CTS	TXD+
9	RI	TXD–

DB-25 Connector

Figure D-7 and Table D-3 give the pin locations and descriptions of the DB-25 connector, which is on the optional DB-9 to DB-25 converter.

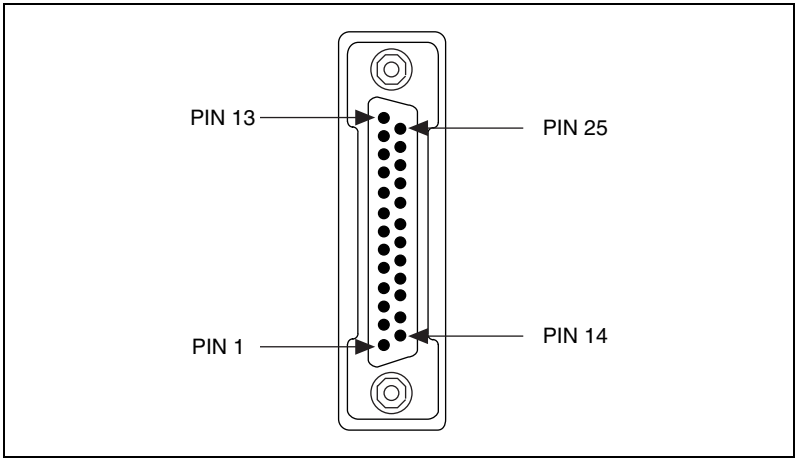


Figure D-7. DB-25 Connector Pin Locations

Table D-3. DB-25 Pin Descriptions

DB-25 Pin	232 Signal	485 Signal
2	$\overline{\text{TXD}}$	RTS+ (HSO+)
3	$\overline{\text{RXD}}$	CTS+ (HSI+)
4	RTS	RTS– (HSO–)
5	CTS	TXD+
6	DSR	CTS– (HSI–)
7	GND	RXD–
8	DCD	GND
20	DTR	RXD+
22	RI	TXD–
Pins not listed in this table are No Connect.		

Connecting Two-Wire Devices

The ENET-485 is designed to work with either two- or four-wire devices. If you are using a two-wire device, refer to the device documentation for specific wiring instructions.

In general, half-duplex networks use a single twisted pair of wires for communication in both directions, so you must connect both the transmitter and the receiver at each end of the same pair of wires. For example, to connect an RS-485 data acquisition device to a port on your ENET-485 using half-duplex communication, you need a single twisted pair of wires. At the ENET-485, connect the TXD+ and RXD+ signals (pins 8 and 4 on a DB-9 connector, pins 5 and 20 on a DB-25 connector) together and to one wire. Connect the other end of this wire to both the TXD+ and RXD+ signals on the data acquisition device. Use the same method to connect the TXD– and RXD– signals (pins 9 and 5 on a DB-9 connector, pins 22 and 7 on a DB-25 connector) to the second wire.

For information about setting the transceiver mode for two-wire communication, refer to Chapter 6, *Using Your Serial Device Server*.

E

Specifications

This appendix describes the characteristics of the serial device server and the serial server software, along with the recommended operating conditions.

Electrical Characteristics

Power supply unit

100–120 VAC	±10%, 60 Hz
220–240 VAC	±10%, 50 Hz

Current requirements (with power supply unit)

100–120 VAC	125 mA maximum 90 mA typical
220–240 VAC	85 mA maximum 60 mA typical

Device power consumption

9 W	maximum
6.5 W	typical

Environmental Characteristics

Operating temperature	–40° to 70° C
Relative humidity, operating	10% to 90% noncondensing conditions
Storage temperature	–55° to 85° C
Relative humidity, storage	5% to 90% noncondensing conditions
EMI	FCC Class A Verified

Physical Characteristics

Overall case size (dimensions) .....21.0 by 12.4 by 3.7 cm
(8.25 by 4.89 by 1.44 in.)

Case material .....Hard plastic with metal baseplate

Weight .....394 g (0.87 lb)

Software Characteristics

Space required for NI-Serial server
software .....2 MB

Electrostatic Discharge Protection

Non-isolated devices.....1.5 kV

Network Specifications

Ethernet connector RJ-45

Connection type .....IEEE 802.3 compliant
100Base-TX (100 Mbits/s)
10Base-T (10 Mbits/s)

Duplex mode.....Half duplex

Serial Specifications

Serial connectors.....DB-9

Maximum serial transfer rate[1]

RS-485 .....460.8 kbits/s

RS-232 .....230.4 kbits/s

RS-232 port type.....DTE

[1] Actual speed may vary considerably from speed shown due to system, network, and instrumentation capabilities.

F

VISA and Serial APIs on UNIX

To access the serial ports on an ENET-Serial box under a UNIX architecture such as Solaris or Linux, you must use the NI-VISA driver. You can use the device I/O API on these platforms to access local serial ports (open, write, etc.); however, you cannot use it to access the ports on the ENET-Serial box. The API on Solaris and Linux was not designed to access remote serial ports and thus cannot support this functionality.

Fortunately, the VISA architecture supports use of the ENET-Serial devices, as well as local serial ports and many others. The VISA architecture is simple to use and is both bus type independent and cross platform compatible.

For serial users who are familiar with the UNIX serial API, the following table shows the several common UNIX device-level function calls and the corresponding VISA operations. As you can see, the APIs are very similar.

Table F-1. UNIX Function Calls and Corresponding VISA Operations

Solaris Function	Linux Function	VISA Operation
open	open	viOpen
close	close	viClose
tcgetattr/ioctl	tcgetattr/ioctl	viGetAttribute
tcsetattr/ioctl	tcsetattr/ioctl	viSetAttribute
read	read	viRead
aioread	read	viReadAsync
write	write	viWrite
aiowrite	write	viWriteAsync
aiowait	select	viWaitOnEvent

In many cases, the VISA operations are even easier to use than the conventional UNIX serial API. For example, in the UNIX API you must manipulate complex bits in the termios structure. However, to make identical operations in VISA, you just make a simple call to

viSetAttribute. VISA attributes are robust and cover many types of information and configuration functions, including port settings and modem lines.

VISA is extensible to other hardware interfaces and is supported on various platforms. Therefore, if you are programming multiple devices that communicate over more than one bus type, it may be easier to use VISA for your entire system.

The default settings for a serial VISA session are 9600 baud, 8 data bits, 1 stop bit, no parity, and no flow control. A port is set to these settings following a successful call to viOpen. However, once a session to the port is opened, you can change these settings on a per session basis using viSetAttribute. To have a different set of default values following a successful viOpen operation, use the visaconf utility to change the default settings in use when a port is opened. (You must use the VI_LOAD_CONFIG parameter in viOpen for this option.) See the *NI-VISA User Manual* for more details.

The following example shows how to use some of the VISA operations.

```
int main(void)
{
   char instrDescriptor[VI_FIND_BUFLEN];
   char buf[1024];
   ViSession defaultRM, instr;
   ViStatus status;
   ViUInt32 numAvailBytes, retCount;
   ViEventType eventType;
   ViEvent eventContext;

   int i;
   /* First we will need to open the default resource manager. */
   status = viOpenDefaultRM (&defaultRM);
   if (status < VI_SUCCESS)
   {
      printf("Could not open a session to the VISA Resource Manager!\n");
      return -1;
   }

   /* Set descriptor to a serial port at port 2 of the serial device server
   at IP address 130.164.41.41 */
   strcpy(instrDescriptor, "ASRL::130.164.41.41::2::INSTR");
   printf("Opening %s \n",instrDescriptor);
```

```
   /* Now we will open a session to the instrument we just found. */
   status = viOpen (defaultRM, instrDescriptor, VI_NULL, VI_NULL, &instr);
   if (status < VI_SUCCESS)
   {
      printf ("An error occurred opening a session to %s\n",instrDescriptor);
      viClose(defaultRM);
      return -1;
   }

   /* Set the baud rate to 115200.  This takes effect immediately. */
   /* Error checking has been removed from this point on for clarity. */
   status = viSetAttribute(instr, VI_ATTR_ASRL_BAUD, 115200);

   /* Write a value to the port */
   strcpy(buf, "This is a test string\n");
   status = viWrite(instr, buf, strlen(buf), &retCount);

   /* See how many bytes are available to be read in the port. */
   /* Note: In viGetAttribute, the third parameter type changes based on the */
   /* value of the second parameter. */
   status = viGetAttribute(instr, VI_ATTR_ASRL_AVAIL_NUM, &numAvailBytes);

   printf("%d bytes available to be read at this instance in time.\n",
   numAvailBytes);

   /* Read the next numAvailBytes bytes or until a TERMCHAR is sent ('\n' by */
   /* default)  (see  VI_ATTR_TERMCHAR, VI_ATTR_TERMCHAR_EN, and */
   /* VI_ATTR_ASRL_END_IN for more details). */
   status = viRead(instr, buf, numAvailBytes, &retCount);

   /* Close the session to the port. */
   viClose(instr);

   /* Close the resource manager session. */
   viClose(defaultRM);

   return 0;
}
```

Summary

VISA is the only mechanism available in UNIX systems such as Solaris and Linux to access the ENET-Serial serial ports. Due to the similarity between UNIX system calls for serial access and VISA operations, the transition to the VISA architecture should be relatively painless. And with VISA, switching your code for use with another supported device, even on different buses using different operating systems, is usually as easy as changing the resource string on the call to `viOpen`.

G

Technical Support Resources

Web Support

National Instruments Web support is your first stop for help in solving installation, configuration, and application problems and questions. Online problem-solving and diagnostic resources include frequently asked questions, knowledge bases, product-specific troubleshooting wizards, manuals, drivers, software updates, and more. Web support is available through the Technical Support section of `ni.com`.

NI Developer Zone

The NI Developer Zone at `ni.com/zone` is the essential resource for building measurement and automation systems. At the NI Developer Zone, you can easily access the latest example programs, system configurators, tutorials, technical news, as well as a community of developers ready to share their own techniques.

Customer Education

National Instruments provides a number of alternatives to satisfy your training needs, from self-paced tutorials, videos, and interactive CDs to instructor-led hands-on courses at locations around the world. Visit the Customer Education section of `ni.com` for online course schedules, syllabi, training centers, and class registration.

System Integration

If you have time constraints, limited in-house technical resources, or other dilemmas, you may prefer to employ consulting or system integration services. You can rely on the expertise available through our worldwide network of Alliance Program members. To find out more about our Alliance system integration solutions, visit the System Integration section of `ni.com`.

Worldwide Support

National Instruments has offices located around the world to help address your support needs. You can access our branch office Web sites from the Worldwide Offices section of `ni.com`. Branch office Web sites provide up-to-date contact information, support phone numbers, e-mail addresses, and current events.

If you have searched the technical support resources on our Web site and still cannot find the answers you need, contact your local office or National Instruments corporate. Phone numbers for our worldwide offices are listed at the front of this manual.

Glossary

Prefix	Meaning	Value
p-	pico-	10^{-12}
n-	nano-	10^{-9}
µ-	micro-	10^{-6}
m-	milli-	10^{-3}
c-	centi-	10^{-2}
k-	kilo-	10^{3}
M-	mega-	10^{6}
G-	giga-	10^{9}
t-	tera-	10^{12}

°	degrees
%	percent
Ω	ohms
A	amperes
ANSI	American National Standards Institute
b	bits
B	bytes
baud	signaling rate of a line in transitions per second
C	Celsius
COM	Computer Output Microform; used in reference to a communication port
CTS	Clear To Send
DB-*xx*	subminiature D connector, where *xx* is the number of pins

DCD	Data Carrier Detect
DCE	Data Communications Equipment or Data Circuit-Terminating Equipment
DHCP	Dynamic Host Configuration Protocol
DSR	Data Set Ready
DNS	domain name server
DTE	Data Terminal Equipment
$\overline{\text{DTR}}$	Data Terminal Ready—the overscore denotes that the signal is active low
duplex	the means of bandwidth usage in a serial system
EIA	Electronic Industries Association
EEPROM	electrically erasable programmable read-only memory
EMI	electromagnetic interference
FCC	Federal Communications Commission
FIFO	First-In-First-Out
ft.	feet
g	grams
GND	ground
HSI	Handshake Input
HSO	Handshake Output
Hz	hertz
IEEE	Institute of Electrical and Electronic Engineers
in.	inches
I/O	input/output
IP	Internet Protocol
IRQ	interrupt request

ISA	Industry Standard Architecture
LED	light-emitting diode
lb.	pounds
m	meters
MB	megabytes of memory
NIC	network interface card
PC	personal computer
RAM	random-access memory
RI	Ring Indicator
RX	Receive
$\overline{\text{RXD}}$	Receive Data—the overscore denotes that the signal is active low
RTS	Request to Send
s	seconds
TCP	Transmission Control Protocol
TX	Transmit
$\overline{\text{TXD}}$	Transmit Data—the overscore denotes that the signal is active low
UART	Universal Asynchronous Receiver/Transmitter
V	volts
VAC	volts alternating current
VDC	volts direct current
Win16	describes a 16-bit Windows application
Win32	describes a 32-bit Windows application

Index

A

adding a new serial interface
  Linux *x*86/Solaris 2.*x*, 4-3
  Windows 2000/NT 4.0, 4-1
advanced transceiver control for the ENET-485
  four-wire mode, 6-8
  setting transceiver control mode
    Linux *x*86/Solaris 2.*x*, 6-10
    Windows 2000/NT 4.0, 6-9
  transceiver control modes (table), 6-7
  two-wire mode: auto control, 6-8
  two-wire mode: DTR controlled, 6-8
  two-wire mode: DTR with Echo, 6-8

B

baud rate
  maximum, C-12, C-15
  setting, C-12, C-15
bias resistors
  changing, 6-12
  functionality, 6-11
  location, 6-13
  using in transmission line (figure), 6-11

C

cable connectors
  DB-25, D-8
  DB-9, D-7
cables
  connecting, 2-3
  verifying proper Ethernet cable type, C-6, C-8
caution
  using firmware update utility, 6-7
CFG RESET switch
  if hosts are connected, 6-3
  location, 6-3
  using to enter network configuration mode, 6-3
  using to reset default network characteristics, 6-4
COM port number
  changing, 4-5
comment
  to help identify device on network, 3-5
common questions
  Linux *x*86/Solaris 2.*x*, C-14
  Windows 2000/NT 4.0, C-8
communication
  over the serial bus, C-12, C-15
communication port settings
  adding a new serial interface
    Linux *x*86/Solaris 2.*x*, 4-3
    Windows 2000/NT 4.0, 4-1
  configuring, 4-1
  viewing or changing
    Linux *x*86/Solaris 2.*x*, 4-6
    Windows 2000/NT 4.0, 4-3
communication problems
  after configuring serial device server, C-11
  between DHCP and DNS, 6-3
  connecting to serial device server, C-6
  with devices on other subnets, C-3
  with NI Ethernet device configuration, C-14, C-16
comparison to VISA API, F-1
Configuration Reset switch. *See* CFG RESET switch

connecting
cables, 2-3, 5-3
serial devices, 2-4, 5-3
two-wire devices, D-9
contacting National Instruments, F-2
conventions, *xi*
cover
removing (figure), 6-12
CreateFile API
failure, C-11
restrictions, C-11
customer
education, F-1
technical support, F-1

D

data
problems sending or receiving, C-4
DB-25 connector, D-8
pin descriptions (table), D-8
pin locations (figure), D-8
DB-9
pin descriptions (table), D-7
pin locations (figure), D-7
DCE vs. DTE, D-6
default configuration
resetting, 6-4
default hostname
location, 2-2
using to add new serial interface, 4-2
determining
firmware version, C-9, C-15
physical port associated with a COM port, C-9
software version, C-8, C-14
Developer Zone, F-1
development tools for saving time, 1-6
Device Manager
information about serial ports, C-11
DeviceIoControl
setting transceiver mode with, 6-9
DeviceIoControl(), 6-9
input values (table), 6-9
DHCP
benefits and purpose, 6-2
configuring network settings automatically, 2-4
configuring network settings without DHCP, 2-5, 3-1
confirming its availability, 2-4
if DHCP does not configure network parameters, C-1
registering hostname and IP address, 3-4
risks for failure, 6-2
using with DNS, 6-2, C-2
DHCP failure
communication failure between DHCP and DNS, 6-3
if no IP addresses available, 6-2
diagnostic messages
Linux *x*86/Solaris 2.*x*
VI_ERROR_RSRC_BUSY, C-8
VI_ERROR_RSRC_NFOUND, C-7
Windows 2000/NT 4.0
could not connect to serial device server, C-6
could not directly access the serial port, C-7
could not locally access the serial port, C-7
environment is not configured properly, C-5
error reading registry, C-5
failed to open network connection, C-5
required file is missing, C-5
serial device server refused request, C-7
diagnostic resources, F-1

diagnostics errors
troubleshooting, C-15
diagnostics utility. *See* Serial Device Server Diagnostics utility
distance capabilities, 1-3
DNS
registration, 3-5
using with DHCP, 6-2, C-2
DNS server, 3-6
DNS table
manually configuring, C-2
manually inserting hostname, 6-3
using NSLookup, C-2
documentation flowchart, 1-1
DOS applications
using with serial device server, C-13
DTE vs. DCE, D-6
DTE-to-DCE interface, D-6
straight-through cabling in (figure), D-6
DTE-to-DTE interface, D-6
null-modem cabling in (figure), D-6
duplex architectures
full duplex, D-3
half duplex, D-4
overview, D-3
Dynamic Host Configuration Protocol. *See* DHCP

E

electrical characteristics, E-1
electrostatic discharge protection, E-2
ENET-485
advanced transceiver control for
transceiver control modes (table), 6-7
two-wire mode: auto control, 6-8
two-wire mode: DTR controlled, 6-8
two-wire mode: DTR with Echo, 6-8
changing bias resistors, 6-11
configuring transceiver modes, 6-7
connecting two- or four-wire devices, D-9
setting transceiver control mode
Linux *x*86/Solaris 2.*x*, 6-10
Windows 2000/NT 4.0, 6-9
environmental characteristics, E-1
error messages
example, B-2
interpreting, B-1
recording, B-2
Ethernet
connecting to serial device server, 2-3
NI Ethernet device configuration, 3-1
Ethernet address
location, 2-2

F

failure
cannot connect to network, C-5
connecting to serial device server, C-6
red PWR/RDY LED, C-4
using Serial Device Server Diagnostics utility, C-12
FIFO settings, 4-5
firmware
See also NI Ethernet Device Firmware Update utility
determining version, C-9, C-15
updating, 6-5
Linux *x*86/Solaris 2.*x*, 6-7
Windows 2000/NT 4.0, 6-6
four-wire mode, 6-8
frequently asked questions, F-1
front panel (figure), 1-4
full duplex, D-3
full-duplex system (figure), D-4

G

gateway settings
assigning, 3-6
confirming proper settings, C-3

general port settings
COM port number, 4-5
FIFO settings, 4-5
transceiver mode, 4-5
general programming requirements, 6-1
getting started, 1-2

H

half duplex, D-4
half-duplex system (figure), D-4
hardware problems
cannot open port, C-4
cannot send/receive data, C-4
Ethernet LEDs flash in unison, C-4
PWR/RDY LED continues to flash, C-4
PWR/RDY LED is red, C-4
scrambled data, C-4
unit does not power on, C-3
help
technical support, F-1
hostname
accepting DNS hostname, 3-8
changing DNS entry, 3-8
default hostname, 2-2
determining, 6-5
determining hostname for any IP address, C-2
editing, 3-8
problem accessing device, C-2
registered with DNS, C-2
resolving verification error, 3-8
using to add new serial interface, 4-2
using to identify device, 6-3
verifying, 3-7
viewing or changing, 3-4
humidity
operating and storage, E-1

I

installation
getting started, 1-2
verification, 5-1
Linux *x*86/Solaris 2.*x*, 5-2
Windows 2000/NT 4.0, 5-1
installing
bias resistors on ENET-485, 6-12
serial device server, 2-2
serial server software, 2-1
terminating resistors, D-5
IP address
acquiring automatically using DHCP, 2-4
assigning manually, 3-2
choosing a static IP address, 3-6
defined, 3-6
determining, 6-5
static IP address, 6-3
using to add new serial interface, 4-2
IP address assignment
if error message, 2-5
if failed, 2-5
if not successful, 2-5
if successful, 2-4
IP parameters
DNS server, 3-6
gateway IP, 3-6
if assigned by network administrator, 3-6
if assigned by user, 3-6
IP address, 3-6
static IP parameters, 3-6
subnet mask, 3-6
ipconfig
viewing network settings, C-3

K

kit contents, 1-2

L

label
figure, 2-3
information to record, 2-2
location, 2-2
LEDs
See also PWR/RDY LED
description of each (table), 1-5
Ethernet LEDs, C-4
overview, 1-4

M

missing files, C-5
multidrop network using terminating resistors (figure), D-5

N

naming serial ports, C-10
National Instruments
Alliance Program, F-1
customer education, F-1
Developer Zone, F-1
system integration services, F-1
technical support, F-1
Web support, F-1
worldwide offices, F-2
National Instruments application software
LabVIEW, 1-6
Lookout, 1-6
Measurement Studio, 1-6
using with your serial device server, 1-7, 6-1
network administrator
assigning static IP parameters, 3-6
configuring DNS table, C-2
confirming DHCP availability, 2-4
if DHCP fails, 6-3
network cable types, 1-2, C-6, C-8
network configuration mode
entering automatically, 3-1
entering manually, 3-1, 6-3
when not required, 3-1
when to use, 3-1
network problems
cannot change network settings, C-2
communication problems with other subnets, C-3
device not shown in NI Ethernet device configuration, C-1
DHCP does not configure network parameters, C-1
hostname cannot access device, C-2
network settings
changing, 3-4
configuring with DHCP, 2-4
configuring without DHCP, 3-1, 3-5
determining, C-3
problems configuring, C-2
network specifications, E-2
NI Developer Zone, F-1
NI Ethernet device configuration
! shown on device listing, 3-8
accessing with CFG RESET switch, 6-3
assigning IP address manually, 3-2
busy device, 3-2, C-13, C-16
if serial device server is not listed, C-14, C-16
network configuration mode, 3-1
possible device states, 3-2
Properties menu, 3-3
Refresh option, 3-3, C-14, C-16
starting, 3-2
troubleshooting, C-1
unconfigured device, 3-2
viewing settings in normal mode, 3-1
when to use, 2-5, 3-1
when you do not need to use, 2-5

NI Ethernet Device Firmware Update utility
before using, 6-5
example (figure), 6-6
important warning, 6-7
running, 6-5
when to use, 6-5
NI Ports utility
figure, 4-4
adding a new serial interface
Linux *x*86/Solaris 2.*x*, 4-3
Windows 2000/NT 4.0, 4-1
displaying list of installed NI serial ports, C-8
resolving registry error, C-5
restoring, C-13
setting transceiver control mode
Linux *x*86/Solaris 2.*x*, 6-10
Windows 2000/NT 4.0, 6-9
verifying most current version, C-13
viewing or changing communication port settings
Linux *x*86/Solaris 2.*x*, 4-6
Windows 2000/NT 4.0, 4-3
NI-VISA
overview, 1-6
NSLookup utility
determining hostnames, C-2
null-modem cabling in a DTE-to-DTE interface (figure), D-6

O

online technical support, F-1
optional equipment, 1-2
overview
features, 1-3
LEDs, 1-4
PWR/RDY LED signaling, B-1
serial device server, 1-3
serial port, 1-3

P

physical characteristics, E-2
pin descriptions
DB-25
connector pin descriptions (table), D-8
connector pin locations (figure), D-8
DB-9
connector pin descriptions (table), D-7
connector pin locations (figure), D-7
ping utility
verifying your serial device server works on your network, C-2, C-3
ports
determining ports installed on Linux *x*86/Solaris 2.*x*, C-14
determining ports ready for use on Linux *x*86/Solaris 2.*x*, C-14
maximum number used simultaneously on Linux *x*86/Solaris 2.*x*, C-14
Ports utility
assigning names to serial ports, C-10
displaying list of all installed COM ports, C-8
power connection, 2-3
power supplies, E-1
programming considerations, 6-1
properties
configuring, 3-4
specifying IP settings manually (figure), 3-5
unconfigured serial device server (figure), 3-4
PWR/RDY LED
description, 1-5
if alternating rapidly, B-1
if blinking a pattern, 2-5, B-1
if flashing rapidly, 3-1

if red, 2-5
if still flashing, C-4
if yellow, 2-4, B-1
interpreting status messages, B-1
observing during self tests, 2-4
overview, B-1
when using CFG RESET switch, 6-4

R

readme.txt file
location, C-8, C-14
rear panel (figure), 2-3, 5-3
rebooting
after firmware update, 6-7
after uninstalling the software, A-3
to set new Ethernet configuration, 3-6
to set new software configuration, 4-2
Refresh
discovering new devices on subnet, 3-3
updating list of Ethernet devices, 3-3
verifying hostname, 3-9
registry error, C-5
related documentation, *xii*
removing
serial server software
Linux *x*86/Solaris 2.*x*, A-4
Windows 2000/NT 4.0, A-1
top cover (figure), 6-12
resetting default network characteristics, 6-4
RS-232 standard
features (table), D-1
overview, D-1
RS-422 standard
features (table), D-1
overview, D-2
RS-485 standard
features (table), D-1
overview, D-2

S

self tests
if not passed, 2-5
if passed, 2-4
serial communication issues
cable connections, D-7
connecting two-wire devices, D-9
DTE vs. DCE, D-6
duplex architectures, D-3
termination, D-5
Serial Configuration utility. *See* NI Ports utility
serial device server
diagnostics utility
Linux *x*86/Solaris 2.*x*, 5-2
Windows 2000/NT 4.0, 5-1
features, 1-3
general programming requirements, 6-1
getting started, 1-2
installing, 2-2
LEDs, 1-4
overview, 1-3
powering on, 2-4
timeout problems, C-12, C-15
unconfigured device, 3-3
using with DOS applications, C-13
using with Win16 applications, C-13
Serial Device Server Diagnostics utility
closing ports before using, C-7
fails with error, C-12
purpose, 5-2
running
Linux *x*86/Solaris 2.*x*, 5-2
Windows 2000/NT 4.0, 5-1
starting (figure), 5-1
test results (figure), 5-2
serial devices
connecting, 5-3

serial number
location, 2-2
serial ports
assigning names, C-10
configuring, 4-1
connecting devices, 5-3
determining associated physical ports, C-9
displaying list of installed NI serial ports, C-8
general information, D-1
information in Device Manager, C-11
location (figure), 5-3
maximum supported, C-12
overview, 1-3
problem accessing directly, C-7
problem accessing locally, C-7
problem opening port, C-4
serial server software
determining version, C-8, C-14
getting started, 1-2
installing, 2-1
maximum serial ports, C-12
overview
Linux *x*86/Solaris 2.*x*, 1-6
Windows 2000/NT 4.0, 1-5
space required, E-2
uninstalling
Linux *x*86/Solaris 2.*x*, A-4
Windows 2000/NT 4.0, A-1
serial specifications, E-2
setting transceiver control mode
Linux *x*86/Solaris 2.*x*, 6-10
setting with DeviceIoControl(), 6-9
Windows 2000/NT 4.0, 6-9
software
characteristics, E-2
determining version, C-8, C-14
installing, 2-1
specifications
electrical characteristics, E-1
environmental characteristics, E-1
network specifications, E-2
physical characteristics, E-2
serial specifications, E-2
software characteristics, E-2
static IP address
when easier than using DNS, 6-3
static IP parameters
if DHCP not available, 3-6
using instead of DHCP, 3-8
straight-through cabling in a DTE-to-DCE interface (figure), D-6
subnet mask, 3-6
subnets
communicating with other subnets, C-3
system integration, by National Instruments, F-1

T

TCP/IP protocol
verifying, C-5
technical support
before contacting, B-2
technical support resources, F-1
telephone technical support, F-2
temperature
operating and storage, E-1
terminating a transmission line, D-5
termination
multidrop network using terminating resistors (figure), D-5
training, customer, F-1
transceiver control modes (table), 6-7
transceiver mode, 4-5
configuring, 6-7
setting with DeviceIoControl, 6-9

transmission line using bias resistors (figure), 6-11
troubleshooting
common questions
Linux *x*86/Solaris 2.*x*, C-14
Windows 2000/NT 4.0, C-8
diagnostic messages, C-5
hardware problems, C-3
network problems, C-1
troubleshooting resources, F-1
two-wire devices
connecting, D-9

U

uninstalling software
Linux *x*86/Solaris 2.*x*, A-4
removing all components, C-12
Windows 2000/NT 4.0, A-1
UNIX function calls and corresponding VISA operations (table), F-1
UNIX serial API, F-1
updating the firmware, 6-5
Linux *x*86/Solaris 2.*x*, 6-7
Windows 2000/NT 4.0, 6-6
using
CFG RESET switch, 6-3
DHCP, 6-2
other National Instruments applications, 1-6
this manual, 1-1

V

verifying
hostname, 3-7
installation, 5-1
network interface card in computer, C-5
serial device server works with your network, C-2, C-3
TCP/IP protocol, C-5
voltage rating, 2-2
version
firmware, C-9, C-15
serial server software, C-8, C-14
VI_ATTR_ASRL_WIRE_MODE, 6-10
VISA API
comparison to UNIX serial API, F-1
VISA operations
example code, F-1, F-2
voltage rating, E-1
caution, 2-2
verifying before use, 2-2

W

Web support from National Instruments, F-1
Win16 applications
using with serial device server, C-13
Win32 Overviews and Win32 Reference, 6-1
Win32 Software Development Kit, 6-1
worldwide technical support, F-2